CONFIDENTIAL INFORMATION TO BE WITHHELD FROM PUBLIC DISCLOSURE
PURSUANT TO 10 CFR 2.390 & 10 CFR 9.17

TMI-2 SOLUTIONS

February 19, 2021
TMI2-RA-COR-2021-0002

10 CFR 50.51
10 CFR 50.82(a)(7)

U.S. Nuclear Regulatory Commission
ATTN; Document Control Desk
Washington, DC 20555-0001

Subject: License Amendment Request – Three Mile Island, Unit 2, Decommissioning Technical Specifications

Three Mile Island, Unit 2
NRC Possession Only License No. DPR-73
NRC Docket No. 50-320

References:

1) Letter TMI-19-112 from Halnon, G.H. (GPU Nuclear, Inc.), and Sauger J. (TMI-2 Solutions LLC), "Application for Order Approving License Transfer and Conforming License Amendments," (ML19325C600) dated November 12, 2019.

2) Letter from USNRC to Sauger, J. (TMI-2 Solutions, LLC), "Three Mile Island Nuclear Station, Unit No. 2 – Issuance of Amendment No. 64 Re: Order Approving Transfer of License and Conforming License Amendment (EPID L-2019-LLA-0257)," (ML20352A381) dated December 18, 2020.

3) Letter TMI2-2020-005 from van Noordennen, G.P. (TMI-2 Solutions), "Receipt of Regulatory Approvals and Insurance Coverage, and Notice of Closing Date for Three Mile Island Unit 2 Transfer," (ML20350B569) dated December 9, 2020.

4) Camper, L. W. (NRC) to Pace, D. L. (GPU Nuclear) letter, "Three Mile Island Nuclear Station, Unit 2 (TMI-2) – Failure to Submit Post-Shutdown Decommissioning Activities Report – Non-cited Violation (Docket: 05000320)," (ML12349A291) dated February 13, 2013.

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit" TMI-2 Solutions, LLC requests an amendment to the Possession Only License (POL) and Appendix A, Technical Specifications (TS), of POL No. DPR-73 ("License") for Three Mile Island Nuclear Station, Unit 2 ("TMI-2"). This

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proposed License Amendment Request (LAR), upon approval, will revise the POL and the associated TS to support the transition of TMI-2 from a Post-Defueling Monitored Storage (PDMS) condition to that of a facility undergoing radiological decommissioning (DECON) pursuant to 10 CFR 50.82(a)(7). An update to the Post-Shutdown Decommissioning Activities Report (PSDAR) will be provided to reflect the transition to DECON under separate cover.

Reference 1 submitted a request for transfer of POL No. DPR-73 from GPU Nuclear, Inc. ("GPU Nuclear") to TMI-2 Solutions. The NRC approved the license transfer in Reference 2 and following the closing of the transaction described in the Purchase and Sale Agreement (Reference 1) (the "Closing"), TMI-2 Solutions became the licensee for TMI-2. The decommissioning of TMI-2 under the TMI-2 Solutions approach will occur in three Phases.

Phase 1 includes planning, engineering and remediation of the remaining core debris; Phase 2 includes typical decommissioning and dismantlement activities for a power reactor and Phase 3 includes long-term storage of debris material. Debris Material is material consisting of pieces of spent nuclear fuel, damaged core material, and high level waste (collectively called, "Debris Material"). Following the license transfer and Closing (Reference 3), TMI-2 entered Phase 1 while remaining in a PDMS condition. Additional information pertaining to Phases 1, 2 and 3 is presented in Section 1, "Summary Description," of Attachment 1.

TMI-2 Solutions intends to substantially complete decommissioning of TMI-2 and release the site by 2037, except for an area set aside, as may be required, for Debris Material storage facilities. As noted in a letter from the NRC to GPU Nuclear, dated February 13, 2013 (Reference 4), the TMI-2 equivalent date to the certificate of cessation of operations was determined to be September 14, 1993. Therefore, the requirements of 10 CFR 50.36(c)(6), "Decommissioning" applies. The revised TMI-2 POL and Technical Specifications (TS) applicable during decommissioning are referred to as the Decommissioning Technical Specifications (DTS).

This amendment proposes to remove or revise certain license conditions and TS requirements to reflect current plant conditions. In general, the changes propose the elimination of those TS no longer applicable based on current plant radiological conditions and updated safe fuel mass limits (SFML). Changes to TS limiting conditions for PDMS, definitions, surveillance requirements, and administrative controls, as well as several license conditions are also proposed. Upon issuance, this proposed amendment will modify the 10 CFR Part 50 License and the TS to support entry into DECON.

TMI-2 Solutions has concluded that the proposed changes present no significant hazards consideration under the standards set forth in 10CFR 50.92.

The proposed changes have been reviewed and approved in accordance with the requirements of the PDMS Quality Assurance Plan.

Attachment 1 to this letter provides a detailed description and evaluation of the proposed changes. Attachment 2 contains a markup of the current POL and TS pages, including the Bases (TS sections that are deleted in their entirety are identified as such, but the associated deleted pages are not included in Attachment 2). Attachment 3 contains the retyped TS pages that represent the DTS. Regulatory commitments are captured in Attachment 4. Attachments 5 presents a calculation that provides the basis for establishing a new Safe Fuel Mass Limit (SFML).

Attachment 7 contains confidential commercial and financial information in the form of the HIC Fire Calculation. TMI-2 Solutions request that this information be withheld from public disclosure pursuant to 10 CFR 2.390, as described in the Affidavit provided in Attachment 6.

TMI-2 Solutions requests review and approval of this proposed amendment by February 15, 2022, to allow for implementation prior to entering into Phase 1b (Decommissioning) which is scheduled to occur in June 2022. TMI-2 Solutions requests a ninety day implementation period of the license amendment.

In accordance with 10 CFR 50.91(b)(1), a copy of this submittal has been sent to the Commonwealth of Pennsylvania.

In the event that the NRC has any questions with respect to the content of this document or wishes to obtain any additional information, please contact me at 860-462-9707.

Sincerely,

Gerard van Noordenne

Gerard van Noordennen
Senior Vice President Regulatory Affairs
TMI-2 Solutions, LLC

Attachments:

Attachment 1 – Proposed Changes to TMI-2 Possession Only License and Technical Specifications

Attachment 2 – Markup of the current POL and TS pages, including the Bases (Marked-Up Pages)

Attachment 3 – Proposed Technical Specifications (Retyped TS Pages)

Attachment 4 – List of Regulatory Commitments

Attachment 5 – Safe Fuel Mass Limits Calculation

Attachment 6 – 10 CFR 2.390 Affidavit

Attachment 7 – High Integrity Container Fire Calculation (PROPRIETARY)

cc w/Enclosures

Ted Smith, NRC Project Manager
NRC Region I Administrator
NRC Lead Inspector

TMI-2 Service List
cc w/o Proprietary Enclosures:

Ken Robuck President and CEO Energy*Solutions* 299 South Main Street, Suite 1700 Salt Lake City, UT 84111 John Sauger President and Chief Nuclear Officer Reactor D&D Energy*Solutions* 121 W. Trade Street, Suite 2700 Charlotte, NC 28202 Mike Lackey Senior Vice President D&D Operations Energy*Solutions* 121 W. Trade Street, Suite 2700 Charlotte, NC 28202 Gerard van Noordennen Senior Vice President Regulatory Affairs Energy*Solutions* 121 W. Trade Street, Suite 2700 Charlotte, NC 28202 Scott Baskett Project Director TMI-2 Solutions 121 W. Trade Street, Suite 2700 Charlotte, NC 28202 Russ Workman General Counsel Energy*Solutions* 299 South Main Street, Suite 1700 Salt Lake City, UT 84111 Daniel F. Stenger Hogan Lovells US LLP 555 13th St NW Washington, D.C. 20004	Director, Bureau of Radiation Protection, Department of Environmental Protection, Commonwealth of Pennsylvania Rachael Carson State Office BLDG. 13TH Floor P.O. Box 8469 Harrisburg, PA 17105-8469 Chief, Division of Nuclear Safety, Bureau of Radiation Protection, Department of Environmental Protection, Commonwealth of Pennsylvania Rachael Carson State Office BLDG. 13TH Floor P.O. BOX 8469 Harrisburg, PA 17105-8469 Chairman, Board of County Commissioners, Dauphin County 112 Market Street 7th Floor Harrisburg, PA 17101 Chairman, Board of Supervisors of Londonderry Township 783 S. Geyers Church Rd. Middletown PA 17057

STATE OF CONNECTICUT)
) SS. Niantic
COUNTY OF NEW LONDON)

Gerard van Noordennen, being duly sworn according to law deposes and says:

I am the Senior Vice President Regulatory Affairs of TMI-2 Solutions, LLC, and as such I am familiar with the contents of this correspondence and the attachments thereto. The matters set forth therein regarding TMI-2 Solutions, LLC, their affiliates, and Three Mile Island Nuclear Station, Unit 2 are true and correct to the best of my knowledge, information and belief.

Gerard van Noordennen
Gerard van Noordennen

Subscribed and Sworn to before me this 19 day of February 2021

Jo-Ann Lewis
Notary Public of Connecticut

JO-ANN LEWIS
NOTARY PUBLIC
MY COMMISSION EXPIRES FEB. 28, 2023

Attachment 6 to TMI2-RA-COR-2021-0002

License Amendment Request

Three Mile Island Nuclear Station, Unit 2

NRC Possession Only License No. DPR-73

10 CFR 2.390 Affidavit

An affidavit is provided consistent with the requirements of 10 CFR 2.390 to withhold information from the public pertaining to the calculation presented in Attachment 6 TSD 21-003 "Decommissioning Radioactive Waste Handling Accident Calculation for TMI-2."

TMI-2 Solutions Proprietary Information Affidavit

Affidavit of Gerard van Noordennen, Senior Vice President Regulatory Affairs, TMI-2 Solutions, LLL.

TMI-2 Solutions, LLC, contracted with Radiation Safety & Control Services, Inc. with respect to the preparation of the following document which is the property of TMI-2 Solutions, LLC, and which is provided in support of this License Amendment Request:

1. TSD 21-003 "Decommissioning Radioactive Waste Handling Accident Calculation for TMI-2

This document consists of proprietary information that TMI-2 Solutions, LLC considers confidential. Release of this information would cause irreparable harm to the competitive position of TMI-2 Solutions, LLC. This basis for this declaration is:

I. This information is owned and maintained as proprietary by TMI-2 Solutions, LLC,

II. This information is routinely held in confidence by TMI-2 Solutions, LLC, and not disclosed to the public,

III. This information is being requested to be held in confidence by the NRC by this petition,

IV. This information is not available in public sources,

V. This information would cause substantial harm to TMI-2 Solutions, LLC, if it were released publicly, and

VI. The information to be withheld was transmitted to the NRC in confidence.

I, Gerard van Noordennen, being duly sworn, state that I am the person who subscribes my name to the foregoing statement, I am authorized to execute the Affidavit on behalf of TMI-2 Solutions, LLC, and that the matters and facts set forth in the statement are true to the best of my knowledge, information, and belief.

Gerard van Noordennen

Gerard van Noordennen
Senior Vice President Regulatory Affairs
TMI-2 Solutions, LLC

Sworn To And Subscribed Before Me This 19 Day of February, 2021

My Commission Expires February 28, 2023

JO-ANN LEWIS
NOTARY PUBLIC
MY COMMISSION EXPIRES FEB. 28, 2023

Attachment 1 to TMI2-RA-COR-2021-0002

License Amendment Request

Three Mile Island Nuclear Station, Unit 2

NRC Possession Only License No. DPR-73

Evaluation of Proposed Changes

Proposed Changes to TMI-2 Possession Only License and Technical Specifications

This attachment provides the information identified below. Upon approval, this license amendment request will revise certain requirements contained within the TMI-2 POL and TS and remove the requirements that would no longer be applicable. The proposed changes to the TMI-2 license support the transition of TMI-2 from a PDMS condition to that of a facility undergoing radiological decommissioning.

1 SUMMARY DESCRIPTION

In accordance with 10 CFR 50.90, "Application for amendment of license or construction permit or early site permit," TMI-2 Solutions, LLC requests an amendment to the Possession Only License (POL) and Technical Specifications (TS), for POL No. DPR-73 ("License") for Three Mile Island Nuclear Station, Unit 2 ("TMI-2"). This proposed License Amendment Request (LAR), upon approval, will revise the POL and the associated TS to support the transition of TMI-2 from a Post-Defueling Monitored Storage (PDMS) condition to that of a facility undergoing radiological decommissioning pursuant to 10 CFR 50.82(a)(7). An update to the PSDAR will be provided, under separate cover to reflect the transition to DECON.

TMI-2 Solutions intends to substantially complete decommissioning of TMI-2 and release the site by 2037, except for an area set aside, as may be required, for debris material storage facilities. Debris Material is defined as pieces of spent nuclear fuel, damaged core material, and high level waste (collectively called, "Debris Material"). As noted in a letter from the NRC to GPU Nuclear, dated February 13, 2013 (Reference 1), the TMI-2 equivalent date to the certificate of cessation of operations was determined to be September 14, 1993. Therefore, the requirements of 10 CFR 50.36(c)(6), "Decommissioning" applies.

The proposed changes would revise certain requirements contained within the POL and TS and remove the requirements that would no longer be applicable. The proposed changes to the POL and TS are in accordance with 10 CFR 50.36(c)(1) through 10 CFR 50.36(c)(5). The proposed changes include revised formatting, numbering, and wording where appropriate to condense the number of pages in the TS without affecting the technical content.

The TMI-2 Solutions TS have been customized over the years to meet the specific needs of the facility. The current TS contain Limiting Conditions for PDMS that provide for appropriate functional capability of equipment required for safe operation of the facility. However, the majority of the existing TS are only applicable with the facility in the PDMS condition. Technical Specifications, Limiting Conditions for PDMS and Surveillance Requirements (SRs) that do not apply during decommissioning are being proposed for deletion. The remaining portions of the TS will be renamed the Decommissioning Technical Specifications (DTS). The DTS provide a continuing acceptable level of safety for the facility as it undergoes decommissioning.

In the development of the proposed TMI-2 DTS, TMI-2 Solutions reviewed the TS requirements from other plants that have permanently shut down, primarily Vermont Yankee (Reference 2), Kewaunee (Reference 3), San Onofre Nuclear Generating Station (Reference 4), and Crystal River Nuclear Generating Station (Reference 5).

This LAR provides a discussion and description of the proposed POL and TS changes, a technical evaluation of the proposed POL and TS changes, and information supporting a finding of No Significant Hazards Consideration (NSHC).

Decommissioning Phases

Phase 1 is comprised of Phase 1a and Phase 1b. Phase 1a pertains to the preparation for decommissioning which includes activities such as engineering, procurement of long-lead time items, and the installation and maintenance of temporary infrastructure. While in Phase 1a, TMI-2 will remain in a PDMS condition. Phase 1b pertains to Debris Material recovery and source term reduction, which includes the recovery, packaging, and storage of Debris Material and the reduction of the overall radiological source term at TMI-2 to levels that are generally consistent with a nuclear plant toward the end of its operational life that has not experienced a core-damage accident. Phase 1b activities are consistent with the definition for active decommissioning (DECON).

Phase 2 refers to the decommissioning and dismantlement of the TMI-2 site to a level that permits the release of the site, except for an area potentially set aside for storage of Debris Material on the ISFSI.

Phase 3 refers to the long-term storage and management of Debris Material at the ISFSI, as well as decommissioning the ISFSI after the Department of Energy (DOE) has removed the multi-purpose storage and transport canisters containing the Debris Material from the site.

2. DETAILED DESCRIPTION AND BASIS FOR THE CHANGES

This proposed amendment would modify the TMI-2 Solutions POL and TS by deleting requirements that are no longer applicable to a facility in the DECON condition, while modifying the remaining portions to comport to Phase 1b, and Phase 2 decommissioning activities.

The proposed changes to the TMI-2 Solutions POL and TS also involve relocating administrative controls from Section 6, "Administrative Controls," to the Decommissioning Quality Assurance Plan (DQAP), and subsequently controlling them in accordance with 10 CFR 50.54(a). This relocation is being proposed pursuant to the criteria contained in 10 CFR 50.36 and in accordance with the recommendations, guidance and purpose of NRC Administrative Letter 95-06 (Reference 6). Relocated content will be incorporated into the DQAP verbatim as presented with the exception of TS sectional cross references e.g., as required by specification 6.9.2.v.

General Analysis Applicable to Proposed Change

There are no design basis accidents (DBAs) associated with TMI-2. TMI-2 does not have a reactor coolant pressure boundary, 99% of the fuel has been removed from the site, and the facility is in a defueled condition. The remaining 1% consists of Debris Material primarily located in inaccessible areas of the reactor vessel and reactor coolant system. The capability to prevent or mitigate the consequences of a DBA is not applicable to TMI-2.

In accordance with 10 CFR 50.2, "Definitions," safety-related systems, structures, and components (SSCs) are those relied on to remain functional during and following design basis events to assure:

1. The integrity of the reactor coolant pressure boundary;
2. The capability to shut down the reactor and maintain it in a safe shutdown condition; or,
3. The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in 10 CFR 50.34(a)(1) or 10 CFR 100.11.

The first two criteria (integrity of the reactor coolant pressure boundary and safe shutdown of the reactor) are not applicable to a plant in a permanently defueled condition. The third criterion is related to preventing or mitigating the consequences of accidents[1] that could result in potential offsite exposures exceeding limits. Analyses have been performed that demonstrate that there are no postulated unanticipated events that could occur during Phase 1a, or postulated accidents that could occur during Phase 1b or Phase 2, that would result in accident releases exceeding the requirements of 10 CFR 100.11 "Determination of exclusion area, low population zone, and population center distance," or the Environmental Protection Agency (EPA) Protective Action Guidelines (PAGs).

GPU Nuclear performed an unanticipated events analysis as presented in Appendix H, Section 8.2 of the PDMS Safety Analysis Report (SAR). The purpose of the analysis was to determine the unanticipated event that produces the bounding radiological dose at the site boundary during PDMS. This analysis provides the measure upon which to ensure that any activity performed during PDMS will not exceed the radiological dose at the site boundary. The guidance of NUREG/CR-2601 "Technology, Safety and Costs of Decommissioning Reference Light Water Reactors following Postulated Accidents" (Reference 7) was used as the basis for the selection of the unanticipated events that were analyzed. The results of this analysis indicate that a fire in the reactor building (RB) with the RB ventilation and purge system in operation is the unanticipated event that produces the bounding radiological dose at the site boundary during PDMS. No major decommissioning activities[2] will occur during PDMS. Therefore, an unanticipated event involving a major fraction of the remaining inventory of radionuclides is not likely. While in Phase 1a, TMI-2 will remain in a PDMS condition.

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[1] There are no DBAs associated with TMI-2. The terms "unanticipated event" and "accident" are used to represent the postulated activities evaluated relative to dose at the site boundary during Phase 1a and Phase 1b respectively.

[2] A major decommissioning activity is defined in 10 CFR 50.2 "Definitions" as any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components for shipment containing greater than class C waste in accordance with § 61.55 of this chapter.

The fire inside of the RB with the RB ventilation and purge in operation was evaluated by the NRC as part of the Exelon request for exemption from portions of 10 CFR 50.47 and 10 CFR 50, Appendix E (Reference 8). Per the TMI-2 Fire Protection Program Evaluation (FPPE) (Reference 9) which was used as an input to the exemption request, the dose at the exclusion area boundary is 13.5 mrem expressed as a bone dose. Due to the isotopic mix (e.g., negligible amounts of iodine) and the nature of potential releases (i.e., particulate matter), a more restrictive basis (i.e., the critical organ) for comparison was selected for reporting dose for TMI-2 fires.

The results of the NRC evaluation confirm the conclusions presented in the PDMS SAR. The TMI-2 facility would not have consequences that could potentially exceed the applicable dose limits in 10 CFR 100.11 and 10 CFR 50.67 and the dose acceptance criteria in Regulatory Guide 1.183 "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" (Reference 10). The analysis demonstrates that 365 days after permanent cessation of power operations, the radiological consequences of the analyzed unanticipated event will not exceed the limits of the EPA early phase PAGs at the Exclusion Area Boundary (EAB). The NRC approved the exemption request to eliminate offsite emergency response (Reference 11) in part based upon the FPPE (Reference 9). As stated in Reference 11 the NRC staff concluded that granting the requested exemptions to Exelon would provide reasonable assurance that an offsite radiological release will not exceed the limits of the EPA PAGs at the site's exclusion area boundary for remaining applicable design-basis accidents. The summary of the NRC analysis of this event relative to dose at the site boundary is presented in Reference 11.

After the issuance of Reference 11, the FPPE (Reference 9) was revised and reissued as revision 13 (Reference 12). Revision 13 of the FPPE uses updated source term information which accounts for 26 years of decay (1992 through 2018) as well as accounting for additional loose contamination. Federal Guidance Reports 11 and 12 (References 13 and 14 respectively) are applied for dose conversion factors.

Reference 12 indicates that the fire inside of the RB with the RB ventilation and purge in operation remains the most limiting unanticipated event and that the dose at the exclusion area boundary is 12.4 mrem expressed as a bone dose which is less than 13.5 mrem as reported in Reference 11. The dose at the site boundary does not exceed the limits presented in 10 CFR 100.11 and the EPA PAGs.

While in Phase 1a, TMI-2 will remain in a PDMS condition. The TS associated with the license transfer are in effect in Phase 1a. The bounding unanticipated event during Phase 1a remains the fire inside the RB with the RB ventilation and purge system in operation.

Following Phase 1a, TMI-2 will transition into Phase 1b. Prior to performing any major decommissioning activities an analysis of credible accidents that may occur during Phase 1b was performed in order to determine the limiting radiological dose at the site boundary.

The results of this analysis indicate that a High Integrity Container (HIC) fire is the event that could occur during decommissioning with the potential of maximizing dose at the site boundary. The HIC fire event is postulated to occur either inside or outside of containment. Outside of containment the release involves an unfiltered, ground level release that takes no credit for the operation of any SSCs to mitigate the consequences of the event. The dose at the site boundary associated with the HIC fire occurring outside of containment bounds the dose from the HIC fire inside of containment with the containment engineered access equipment hatch open, as well as with or without RB ventilation and purge system in operation, and does not exceed the requirements of 10 CFR 100.11 and the EPA PAGs. The HIC fire event does not impact existing Technical Specifications or require the addition of new Technical Specifications.

There are no postulated accidents that can occur inside of the RB during Phase 1b or Phase 2 that result in the dose at the site boundary exceeding the limits of 10 CFR 100.11 and the EPA PAGs including such times as when the containment engineered access equipment hatch is open. The D&D process includes many evolutions that will require the equipment hatch and other RB access points to be open to allow movement of equipment, waste, and other materials into and out of the RB. The Radiation Protection Program (RPP) will identify the controls that will be implemented through procedures during D&D activities occurring inside of the RB. Implementation of these procedures take into account detailed work planning, and execution of the D&D work and support activities, including measures to maintain occupational dose As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning.

The HIC fire does not meet the definition of a DBA since there are no SSCs that are credited to mitigate the event. The TMI-2 PDMS SAR will be updated to address the HIC fire accident.

10 CFR 50.36, "Technical specifications," promulgates the regulatory requirements related to the content of Technical Specifications. As detailed in subsequent sections of this proposed amendment, this regulation lists four criteria to define the scope of equipment and parameters that must be included in TS. In a permanently defueled condition, the scope of equipment and parameters that must be included in the TMI-2 TS is limited to those needed to ensure that the consequences of the accidents are maintained within acceptable limits.

High Integrity Container Accident Methodology

The methodology associated with establishing that a HIC fire represents the accident that produces the worst-case off-site doses during Phase 1b and Phase 2 as well as how the dose is determined is presented below. A detailed calculation has been developed and is presented in Attachment 7.

A review of industry data was performed, the results of which indicate that spent ion exchange resins combusted in polyethylene HICs produces the highest off-site doses. The TMI-2 Safety Evaluation Report (SER) related to PDMS (Reference 15), NUREG/CR-1030 (Reference 17), NUREG-0586, Supplement 1, Volume 1,(Reference 18), and NUREG/CR 2601 Volume 1, (Reference 7) were reviewed in order to establish that the probability of a resin fire or explosion to be in the E-02 to E-05 per year range. This was compared to a Fuel Handling Incident (FHI) probability in order to assign the proper EAB and Low Population Zone (LPZ) dose criterion in accordance with the Alternate Source Term (AST) methodology presented in Regulatory Guide 1.183 (Reference 10). NUREG 1864 (Reference 19) presents a historically based estimate of 3.2E-05 per lift probability of a fuel assembly being dropped. For a decommissioning facility that has 2,668 fuel assemblies (based upon San Onofre Units 1 and 2) in a spent fuel pool, a frequency per lift of 3.2E-05 results in a probability of a drop of 8.54E-02 per year, assuming the campaign can be completed in one year or 4.27E-2 over two years. Thus, in accordance with Regulatory Guide 1.183 (Reference 10) the Fuel Handling Incident EAB and LPZ dose criteria of 6.3 rem is applied as the acceptance criteria for the resin alternate source term.

TMI-2 resin wastewater samples and smear results were used to scale resin stream mixes; decay was corrected to January 1, 2021. The source terms were used to calculate the worst-case source terms that can be shipped for disposal in an 8-120 polyethylene HIC. A combustion release was postulated assuming 100% of the contents were consumed in a 2-hour fire. A bounding and conservative airborne radioactivity release fraction (ARF) of 5E-02 for uncontained plastics was used to calculate the airborne release activity and release rate Q, in Ci/sec. Bounding and conservative EAB and LPZ dispersion coefficients were calculated for a ground release under worst case atmospheric conditions. Stability Class F and a 1 m/sec wind speed are used based upon Regulatory Guide 1.145 (Reference 20) equations and methodologies. The worst case EAB and LPZ deposition coefficients were calculated using Regulatory Guide 1.111 (Reference 21) deposition graphs for a ground release, as well as using the deposition velocity method presented in the NRC approved RASCAL code of 0.003 m/s. Since these deposition velocities are for iodine, a more conservative deposition velocity of 0.01 m/s was chosen based on studies for plastic combustion particulates. The resin inventories at the Class C limit exceed the 1 rem EPA PAG, which represents the limit at which an emergency plan with offsite response capabilities is required. The source terms were adjusted to activities that result in 975 mrem Total Effective Dose Equivalent (TEDE) dose at the EAB, which eliminates the need for an emergency plan with offsite response capabilities. Thus, the MU-F-5B source term in Table 48 "Scaled MU-F-5B Waste Classification to Meet 975 mrem at the EAB" of Attachment 7 is used as the bounding Regulatory Guide 1.183 (Reference 10) source term.

The offsite dose to the maximally exposed individual was evaluated for a fire in containment using the elevated release dispersion coefficient of 7.67E-04 sec/m^3 and taking credit for the 100 factor reduction in the release activity from HEPA filtration from the containment. The whole body dose at the EAB was determined as 4.9 mrem. The unfiltered dose at the EAB from combustion of the source term identified in Table 48 "Scaled MU-F-5B Waste Classification to meet 975 mrem at the EAB" of Attachment 7 in containment would be one-half of 975 mrem or approximately 490 mrem at the EAB which is still below the requirements of 10 CFR 100.11 and the EPA PAGs.

The calculated atmospheric releases, and dispersion and deposition coefficients were used to calculate the airborne radioactivity and ground surface concentrations at the EAB and LPZ outer boundary. Federal Guidance Reports 11 and 12 (References 13 and 14 respectively) dose conversion factors were used to calculate the effective doses from the inhalation, submersion, and ground surface direct radiation pathways with a 2-hour occupancy. The results are below criteria outlined in the following:

- 10 CFR 100.11 for the Exclusion Area Boundary, Low Population Zone outer boundary
- 10 CFR 50.67 (2)(i) and (ii) for the Exclusion Area Boundary, Low Population Zone outer boundary
- Regulatory Guide 1.183 EAB and LPZ dose criteria for high and medium probability occurrences.
- Environmental Protection Agency 1 rem Protective Action Guideline (Reference 22) at the EAB and LPZ.

In summary, the HIC fire does not exceed the limits of 10 CFR 100.11 and the EPA PAGs.

Detailed Discussion

The following tables identify each POL and TS section that is being changed, the proposed change, and the basis for each change. Changes to the POL are addressed first, followed by the TS. Proposed revisions are shown in ***Bold-Italics*** and deletions are shown using ~~strikethrough~~.

Attachment 2 provides the marked-up version of the TMI-2 POL and TS. Proposed changes to the TS Bases are provided for information in Attachment 2. The TSs that are deleted in their entirety are identified below, however the associated deleted pages are not included in Attachment 2. Additionally, the proposed changes to the TS are considered a major rewrite. Revised formatting (margins, font, tabs, etc.) of content is used to create a continuous electronic file. Revised numbering of pages and sections and the deletion of unused placeholders, where appropriate, is used to condense and reduce the number of pages in the TS without affecting the technical content. Since the changes to the TS are considered a major rewrite, revision bars are not used. The changes are considered administrative and are shown in the marked-up pages (Attachment 2).

Possession-Only License Finding 2.C.(1)	
Current License Condition 2.C.(1)	Proposed License Condition 2.C.(1)
(1) Technical Specifications	(1) Technical Specifications

The Technical Specifications, as revised through Amendment No. 64 are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications and all Commission Orders issued subsequent to the date of the possession only license.	The Technical Specifications, as revised through Amendment No. ~~64~~***65*** are hereby incorporated into this license. The licensee shall ~~operate~~ ***maintain*** the facility in accordance with the Technical Specifications and all Commission Orders issued subsequent to the date of the possession only license.
Basis	
This license condition is proposed for revision to reflect approval of the proposed license change. Since the TMI-2 Solutions license no longer authorizes use of the facility for power operation or emplacement or retention of fuel into the reactor vessel as provided in 10 CFR 50.82(a)(2), the removal of the reference to an operating plant provides clarity in the 10 CFR Part 50 license description. Therefore, the change is consistent with the requirements associated with the decommissioning plant.	

Possession-Only License Finding 2.D	
Current License Condition 2.D D. Special Auxiliary and Fuel Handling Building Ventilation Study: Prior to terminating continuous operation of the auxiliary and fuel handling buildings (AFHB) ventilation systems, the special monitoring program of AFHB airborne levels shall be completed. The program shall include at least one year of data prior to entry into PDMS and at least one year of data after entry into PDMS. A report shall be submitted to the NRC containing the results of the program containing sufficient data and analyses to demonstrate that the release rate of particulates with half-lives greater than eight days from the AFHB will be less than 0.00024 µCi/sec when averaged over any calendar quarter. Not included in the calculation of the particulate release rate shall be those periods of time (designated in advance) prior to entry into PDMS during which aggressive	Proposed License Condition 2.D ***Deleted***

decontamination operations were performed in preparation for PDMS. The report shall be submitted to the NRC staff at least 60 days prior to terminating continuous operation of the AFHB ventilation systems.	
Basis	
As stated in the NRC Safety Evaluation for Post-Defueling Monitored Storage dated Dec 28, 1993 (Reference 15), "License Condition 2.D, Special Auxiliary and Fuel Handling Building Ventilation Study, required the submission of one year of data from a special auxiliary and fuel handling building (AFHB) ventilation study. The licensee complied with this requirement and submitted the data on December 22, 1993." The required report for one year after entry into PDMS was submitted via GPU Nuclear Letter C311-95-2248, dated June 1, 1995 (Reference 16). This submittal demonstrated that the maximum potential release rate from the AFHB of particulate radionuclides with half-lives greater than eight days is a small fraction of the 0.00024 µCi/sec limit when averaged over any calendar quarter. The staff has reviewed the submittal by the licensee and found it acceptable. Therefore, as the requirements of this License Condition have been satisfied it should be deleted.	

Possession-Only License Finding 2.E	
Current License Condition 2.E Unfiltered Leak Rate Test: Prior to entry of the facility into Post-Defueling Monitored Storage, the licensee will develop an NRC approved surveillance requirement for the reactor building unfiltered leak rate test that, upon staff approval, will be incorporated as Section 4.1.1.2 of the proposed PDMS Technical Specifications.	Proposed License Condition 2.E ***Deleted***
Basis	
As stated in the Safety Evaluation Report "Post-Defueling Monitored Storage" dated December 28, 1993 (Reference 15), the licensee submitted the proposed surveillance requirement and the NRC staff found it acceptable. Therefore, as the requirements of this License Condition have been satisfied it should be deleted.	

Possession-Only License Finding 2.F	
Current License Condition 2.F Additional Submittals Prior To Post-Defueling Monitored Storage: Prior to	Proposed License Condition 2.F ***Deleted***

entry of the facility into Post-Defueling Monitored Storage, the licensee will submit and implement a site Flood Protection Plan, a site Radiation Protection Plan, an Offsite Dose Calculation Manual, a Post-Defueling Monitored Storage Fire Protection Program Evaluation, a Post-Defueling Monitored Storage Quality Assurance Plan and a Radiological Environmental Monitoring Plan. Additionally, the licensee will submit to the NRC the results of the completed plant radiation and contamination surveys prior to entry into PDMS.	
Basis	
As stated in the Safety Evaluation Report "Post-Defueling Monitored Storage" dated December 28, 1993 (Reference 15), the licensee submitted the required documentation and the NRC staff found it acceptable. Therefore, as the requirements of this License Condition have been satisfied it should be deleted.	

Possession-Only License Enclosure Statement	
Enclosure Statement Enclosure: Appendices A & B Technical Specifications	Proposed Change to Enclosure Statement Enclosure: Appendix~~ces~~ A ~~& B~~ Technical Specifications
Basis	
There is no Appendix B associated with the TMI-2 Technical Specifications, therefore this text is proposed for deletion.	

TS Section 1.0 Definitions

Definitions described in TS Section 1.0 "Definitions" are either proposed for deletion since they are only relevant to TMI-2 during the PDMS condition or proposed for relocation to the Decommissioning Quality Assurance Program (DQAP). This change is administrative in nature and does not impact nuclear safety.

The standard convention of indicating the defined term in ALL CAPITAL LETTERS throughout the TS has been adopted in the DTS.

Definitions Relocated	Basis for Relocation
OFF-SITE DOSE CALCULATION MANUAL	

1.12 OFF-SITE DOSE CALCULATION MANUAL (ODCM) shall contain the methodology and parameters used in the calculation of off-site doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, and in the conduct of the Radiological Environmental Monitoring Program. The ODCM shall also contain (1) the programs required by Section 6.7.4 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and Annual Radioactive Effluent Release Reports required by Specifications 6.8.1.2 and 6.8.1.3.	This definition is cited in Technical Specification 1.18 "SITE BOUNDARY," Technical Specification Section 6.7.4.a "Radioactive Effluent Controls Program," Technical Specification Section 6.7.4.b "Radiological Environmental Monitoring Program," 6.8.1.1 "Annual Radiological Environmental Operating Report," Technical Specification 6.8.1.2 "Annual Radioactive Effluent Release Report," 6.9 "Records Retention" and Technical Specification Section 6.12 "Offsite Dose Calculation Manual (ODCM) which are proposed for relocation to the DQAP. Therefore, the definition of ODCM is proposed for relocation to the DQAP.
<u>SUBSTANTIVE CHANGES</u> 1.15 SUBSTANTIVE CHANGES are those which affect the activities associated with a document or the document's meaning or intent. Examples of non-substantive changes are: (1) correcting spelling; (2) adding (but not deleting) sign-off spaces; (3) blocking in notes, cautions, etc.; (4) changes in corporate and personnel titles which do not reassign responsibilities and which are not referenced in the PDMS Technical Specifications; and (5) changes in nomenclature or editorial changes which clearly do not change function, meaning or intent.	 This definition is cited in Technical Specification Section 6.7.2 "Procedures and Programs," and Technical Specification Section 6.12 "Offsite Dose Calculation Manual (ODCM) which are proposed for relocation to the DQAP. Therefore, the definition of SUBSTANTIVE CHANGES is proposed for relocation to the DQAP.
<u>SITE BOUNDARY</u> 1.18 The SITE BOUNDARY shall be that line beyond which the land is neither owned, nor leased, nor otherwise controlled by TMI-2 Solutions, LLC. The SITE BOUNDARY for gaseous and liquid effluents shall be as shown in the Offsite Dose Calculation Manual (ODCM).	 This definition is cited in Technical Specification Section 6.7.4.a "Radioactive Effluent Controls Program," and Technical Specification Section 6.7.4.b "Radiological Environmental Monitoring Program" which are proposed for relocation to the DQAP. Therefore, the definition of

	SITE BOUNDARY is proposed for relocation to the DQAP.
NPDES PERMIT 1.19 The NPDES PERMIT is the National Pollutant Discharge Elimination System (NPDES) Permit No. PA0009920, effective January 30, 1975, Issued by the Environmental Protection Agency to Metropolitan Edison Company. This permit authorized Metropolitan Edison Company to discharge controlled wastewater from TMI Nuclear Station Into the waters of the Commonwealth of Pennsylvania.	The proposed change is to delete this definition from the current TMI-2 TS and relocate it to the DQAP. The NPDES PERMIT is cited in TS 6.13.2 "Exceeding Limits of Relevant Permits." TS 6.13.2 is proposed for relocation to the DQAP. Therefore, the definition of NPDES PERMIT is proposed for relocation to the DQAP. The NPDES permit is updated to reflect current assignment to Exelon. The NPDES PERMIT is the National Pollutant Discharge Elimination System (NPDES) Permit No. PA0009920, effective ***June 1, 2010***~~January 30, 1975~~, issued by the ***Pennsylvania Department of*** Environmental Protection ~~Agency~~ ***and assigned*** to ***Exelon Generation Company, LLC***. ~~Metropolitan Edison Company.~~ ***This permit authorizes discharge to the Susquehanna River with effluent limitations, monitoring requirements and other conditions within the permit.*** ~~Metropolitan Edison Company to discharge controlled wastewater from TMI Nuclear Station Into the waters of the Commonwealth of Pennsylvania.~~
Proposed Definitions-Deleted	**Basis for Deletion**
ACTION 1.3 ACTION shall be those additional requirements specified as corollary statements to each specification and shall be part of the specifications.	This definition is proposed for deletion since the term is defined in the ODCM.
OPERABLE - OPERABILITY 1.4 A system, subsystem, train, component or device shall be OPERABLE or have	

OPERABILITY when it is capable of performing its specified function(s) and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).	This definition is proposed for deletion since the term is defined in the ODCM.
<u>CHANNEL CALIBRATION</u> 1.5 An instrument CHANNEL CALIBRATION is a test, and adjustment, as necessary, to establish that the channel output responds with acceptable range and accuracy to known values of the parameter which the channel measures or an accurate simulation of these values. CHANNEL CALIBRATION shall encompass the entire channel including equipment activation, alarm or trip, and shall be deemed to include the CHANNEL FUNCTIONAL TEST.	 This definition is proposed for deletion since the term is defined in the ODCM.
<u>CHANNEL CHECK</u> 1.6 A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.	 This definition is proposed for deletion since the term is defined in the ODCM.
<u>CHANNEL FUNCTIONAL TEST</u> 1.7 CHANNEL FUNCTIONAL TEST shall be the injection of a simulated signal into the channel as close to the primary sensor as practicable to verify OPERABILITY including alarm and/or trip functions.	 This definition is proposed for deletion since the term is defined in the ODCM.
<u>FREQUENCY NOTATION</u>	

1.8 The FREQUENCY NOTATION specified for the performance of surveillance requirements shall correspond to the intervals defined in Table 1.1.	This definition is proposed for deletion since the term is defined in the ODCM.
CONTAINMENT ISOLATION 1.9 CONTAINMENT ISOLATION shall exist when: a. Each penetration is: 1. Closed by a manual valve, a welded or bolted blind flange, a deactivated automatic valve secured in a closed position or other equivalent mechanical closure to provide isolation of each penetration, or 2. Open and the pathway to the environment provided with HEPA filter, or 3. Open in accordance with approved procedures. Controls shall be implemented to minimize the time the penetration is allowed open and to specify the conditions for which the penetration is open. Penetrations shall be expeditiously closed upon completion of the conditions specified in the approved procedures, and b. The Equipment Hatch is closed, and c. Each Containment Airlock is operable pursuant to Technical Specification 3.1.1.3.	This definition is proposed for deletion since the term is not used in any Technical Specification.
BATCH RELEASE 1.10 A BATCH RELEASE is the discharge of a discrete volume.	This definition is proposed for deletion since the term is defined in the ODCM.
CONTINUOUS RELEASE 1.11 A CONTINUOUS RELEASE is the discharge of a non-discrete volume, e.g., from a volume or system that has an input flow during the continuous release.	This definition is proposed for deletion since the term is defined in the ODCM.
REPORTABLE EVENTS	

<table>
<tr><td>1.13 A REPORTABLE EVENT shall be any of those conditions specified in Section 50.73 of 10 CFR Part 50.</td><td>This definition is proposed for deletion. The term is defined and codified in the applicable regulations (e.g. 10 CFR 50.72 and 10 CFR 50.73); therefore, the definition need not be repeated in the DTS.</td></tr>
<tr><td><u>STAGGERED TEST BASIS</u>

1.14 A STAGGERED TEST BASIS shall consist of:
a. A test schedule for n systems, subsystems, trains or designated components obtained by dividing the specified test interval into n equal subintervals,
b. The testing of one system, subsystem, train or designated components at the beginning of each subinterval.</td><td>This definition is proposed for deletion since the term is not used in any Technical Specification.</td></tr>
<tr><td>1.16 <u>MEMBER(S) OF THE PUBLIC</u>

MEMBER(S) OF THE PUBLIC means any individual except when that individual is receiving an occupational dose.</td><td>This definition is proposed for deletion since the term is defined in 10 CFR 20.1003; therefore, the definition need not be repeated in the DTS.</td></tr>
<tr><td><u>UNRESTRICTED AREA</u>

1.17 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by TMI-2 Solutions, LLC for purposes of protection of Individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.</td><td>This definition is proposed for deletion since the term is defined in 10 CFR 20.1003; therefore, the definition need not be repeated in the DTS.</td></tr>
<tr><td>TABLE 1.1

<u>FREQUENCY NOTATION</u>

<table><tr><th>NOTATION</th><th>FREQUENCY</th></tr><tr><td>S</td><td>At least once per 12 hours.</td></tr></table></td><td>This definition is proposed for deletion since the term is defined in the ODCM.</td></tr>
</table>

D	At least once per 24 hours.
W	At least once per 7 days.
M	At least once per 31 days.
Q	At least once per 92 days.
SA	At least once per 184 days.
A	At least once per 12 months
R	At least once per 18 months
P	Completed prior to each release.
N/A	Not applicable.

TS SECTION 2.0 SAFETY LIMITS

Pursuant to 10 CFR 50.36(c)(1), Safety limits for nuclear reactors are limits upon important process variables that are found to be necessary to reasonably protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity.

Current TMI-2 TS	Basis for Deletion
2.0 SAFETY LIMITS There are no safety limits which apply to TMI-2 during PDMS.	This section is proposed for deletion in its entirety. There are no safety limits associated with TMI-2. TMI-2 does not have a reactor coolant pressure boundary and is in a permanently defueled condition. Therefore, safety limits are not applicable.

TS SECTION 3/4.0 LIMITING CONDITIONS FOR PDMS AND SURVEILLANCE REQUIREMENTS

TS Section 3/4.0 contains the Limiting Conditions for PDMS and associated Surveillance Requirements (SR) for TMI-2.

TMI-2 proposes to delete all the PDMS related Technical Specifications and not establish any new TS applicable for use in Phase 1b and Phase 2.

Current TMI-2 TS	Basis for Deletion
TS 3/4.0 Limiting Conditions for PDMS and Surveillance Requirements	The Limiting Conditions for PDMS and associated SR presented in TS Section 3/4.0 are applicable in Phase 1a. The Limiting Conditions for PDMS and associated SR presented in TS Section 3/4.0 are proposed for deletion in their entirety during Phase 1b and Phase 2. TS sections 3/4.1 through 3/4.4 are proposed for deletion in Phase 1b and Phase 2. Therefore, there is no need to define Limiting Conditions for operation in Phase 1b and Phase 2 or associated SR.

TS SECTION 3/4.1-CONTAINMENT SYSTEMS

TS Section 3/4.1 contains Limiting Conditions for PDMS that assures that the containment is maintained as a contamination barrier for the residual contamination which remains inside the containment.

This section is proposed for deletion in its entirety. Control of residual contamination inside of containment will be provided by the Radiation Protection Program (RPP) and through implementation of procedures which address execution of D&D work and support activities, including personnel safety as well as measures to maintain occupational dose As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning as applicable. Procedures associated with Phase 1b will be developed to retrieve the remaining core debris and decontaminate high radiation areas. Phase 2 procedures will also be developed, however the focus of these procedures is related to performing D&D operations in a facility which has not experienced an accident. The RPP and associated implementing procedures will control the residual contamination located inside of the containment and therefore achieves the same results as the containment contamination barrier during the PDMS condition. Therefore, the containment isolation Technical Specification Limiting Conditions for PDMS are not required, and do not apply in Phase 1b and Phase 2.

Current TMI-2 TS	Basis for Deletion
3.1.1.1 Containment Isolation	This Technical Specification is proposed for deletion. During PDMS, containment isolation is maintained to assure the containment is properly maintained as a

	contamination barrier for the residual contamination which resides inside the containment. No major decommissioning will occur during Phase 1a. The Phase 1a condition is a continuation of the PDMS condition. While in Phase 1a, TMI-2 Solutions complies with the PDMS TS as revised by the issuance of the License Transfer Amendment which was approved by the NRC in Reference 23. For the PDMS condition, GPU Nuclear performed an unanticipated events analysis as presented in Appendix H, Section 8.2 of the PDMS Safety Analysis Report (SAR). The purpose of the analysis was to determine the unanticipated event that produces the bounding radiological dose at the site boundary during PDMS. The results of this analysis indicate that a fire in the RB with the RB ventilation and purge system in operation is the unanticipated event that produces the bounding radiological dose at the site boundary during PDMS. The fire inside of the RB with the RB ventilation and purge in operation was evaluated by the NRC as part of the Exelon request for exemption from portions of 10 CFR 50.47 and 10 CFR 50, Appendix E (Reference 8). The results of the NRC evaluation confirm that the TMI-2 facility would not have consequences that could potentially exceed the applicable dose limits in 10 CFR 100.11 and the EPA PAGs (Reference 11). After the issuance of Reference 11, the Fire Protection Program Evaluation, Revision 2, (Reference 9) which served as an input to Exelon's exemption request (Reference 8) was revised and reissued as revision 13 (Reference 12). Revision 13 of the Fire Protection Program Evaluation uses updated source term information which accounts for 26 years of decay (1992 through 2018) as well as accounting for additional loose contamination. Federal Guidance Reports 11 and 12 are applied for dose conversion factors. The results presented in Reference 12 indicate that the fire inside of the RB with the RB ventilation and

	purge in operation remains the most limiting unanticipated event. Dose at the site boundary does not exceed the limits presented in 10 CFR 100.11 and the EPA PAGs. Following Phase 1a, TMI-2 will enter Phase 1b and Phase 2. During Phase 1b and Phase 2, major decommissioning activities as defined in 10 CFR 50.2 will be performed. The TMI2 RPP will address control of residual contamination inside of containment during Phase 1b. Development of implementing procedures will take into account the execution of D&D work and support activities, personnel safety, as well as measures to maintain occupational dose As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning as applicable. Procedures associated with Phase 2 will be developed, however the focus of these procedures is related to performing D&D operations in a facility which has not experienced an accident. In support of D&D, engineered access openings in the RB basement and at the RB equipment hatch will be constructed. The RPP and associated implementing procedures will provide the required level of control necessary to maintain residual contamination inside of containment at these as well as other openings such as containment airlocks. Airborne radiation monitoring will be provided at the containment openings. Limiting Condition for PDMS 3.1.1.1 and associated Surveillance Requirement 4.1.1.1 are proposed for deletion upon entry into Phase 1b and Phase 2. During Phase 1b the residual contamination inside containment will be controlled by the RPP and adherence to implementing procedures. Features that may be employed to manage residual contamination during Phase 1b include, • Controlling contamination at the source to minimize release and spread inside of containment, • Filtration of water and rinsing of items removed from underwater operations.

	• Outside of water, typical contamination control processes include utilization of fixatives on components being dismantled, utilization of water misting during dismantlement to preclude the generation of airborne radioactivity, and decontamination of components prior to dismantlement. • Controls that will be implemented for contamination that has been liberated include use of HEPA ventilation, daily radiological surveys and decontamination of accessible surfaces within containment. • Radiological controls will be utilized to maintain worker exposure ALARA and to prevent cross-contamination. • Airborne radiation monitoring at the access openings used for detection of residual contamination. As discussed in Section 2, an analysis has been performed of a HIC fire occurring outside of containment, which represents the most limiting accident to occur in Phase 1b and Phase 2 relative to dose at the site boundary. The results of the analysis verify the plant EAB and LPZ meet the 10 CFR 100.11 dose criteria and the EPA PAG criteria; below which off-site emergency response capabilities are not required. The analysis further demonstrates that the radiological consequences of the HIC fire bound the dose at the site boundary due to fire inside containment with the RB ventilation and purge system in operation. The dose analysis associated with the HIC fire does not take credit for mitigating SSC's. There are no postulated accidents that can occur inside of the RB during Phase 1b or Phase 2 that result in the dose at the site boundary exceeding the limits of 10 CFR 100.11 and the EPA PAGs including such times as when the containment engineered access equipment hatch is open. The D&D process includes many evolutions that will require the equipment hatch and other RB access points to be open to allow movement of equipment, waste, and other materials into and out of the RB. The RPP will identify the controls that will be implemented through

	procedures during D&D activities occurring inside of the RB. Implementation of these procedures take into account detailed work planning, and execution of the D&D work and support activities, as well as measures to maintain occupational dose As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning. The RPP and associated implementing procedures will control the residual contamination located inside of containment. Therefore, maintaining containment isolation as specified in TS 3.1.1.1 and the associated surveillance requirement are no longer required and are proposed for deletion.
3.1.1.2 Unfiltered Leak Rate Testing	This Technical Specification is proposed for deletion. This Technical Specification assures that the unfiltered leak rate from the containment with the RB Breather closed is less than 1/100 of the rate through the RB Breather. During PDMS, airborne activity in the RB as a result of a fire can be released to the environment via one of the following pathways: the RB breather HEPA filter, the RB ventilation purge system HEPA filters, or unfiltered leakage from the RB. An automatic isolation valve in the breather line upstream of the HEPA filter is designed to close at 0.25 psi RB overpressure. If the fire does not result in an RB overpressure greater than 0.25 psi the release would be through the 99% efficient HEPA filter in the RB Breather line. If the RB ventilation and purge system is operating and fails to isolate on a 0.25 psi pressure signal, the release would be through the 99% efficient HEPA filters in the RB Purge System exhaust line. If the RB Purge System is not operating and the automatic isolation valve in the RB breather line closes, the RB would be effectively isolated with any release being through an unfiltered leakage path. In all the above scenarios, only 1% or less of the RB airborne activity would be released to the environment.

	No major decommissioning activities will occur during Phase 1a. The Phase 1a condition is a continuation of the PDMS condition. While in Phase 1a, TMI-2 Solutions complies with the PDMS TS as revised by the issuance of the License Transfer Amendment which was approved by the NRC in Reference 23. Following Phase 1a, TMI-2 will enter Phase 1b and Phase 2. During Phase 1b and Phase 2, major decommissioning operations as defined in 10 CFR 50.2 will be performed. Limiting Condition for PDMS 3.1.1.2 and associated Surveillance Requirement 4.1.1.2 are proposed for deletion upon entry into Phase 1b and Phase 2. The purpose of the breather during PDMS is to provide passive pressure control of the containment relative to atmospheric pressure and to support measurement of unfiltered leakage from containment. With the construction of the engineered openings in containment at the RB equipment hatch and in the RB basement, the breather no longer provides a preferred path to the atmosphere. Furthermore, no credit is taken for the containment as a pressure containing boundary and therefore performing unfiltered leak rate testing of the containment using the breather is no longer applicable. As discussed in Section 2, an analysis has been performed of a HIC fire occurring outside of containment, which represents the most limiting accident to occur in Phase 1b and Phase 2 relative to dose at the site boundary. The results of the analysis verify the plant EAB and LPZ siting's meet the 10 CFR 100.11 dose criteria, as well as the EPA PAG criteria; below which off-site emergency response capabilities are not required. The analysis further demonstrates that the radiological consequences of the HIC fire bound the dose at the site boundary due to fire inside containment with the RB ventilation and purge system in operation. The dose analysis associated with the HIC fire does not take credit for mitigating SSC's.

	Maintaining the ability to perform unfiltered leak rate testing is not required in Phase 1b and Phase 2. Therefore TS 3.1.1.2 and associated Surveillance Requirement 4.1.1.2 are proposed for deletion.
3.1.1.3 Containment Air Locks	This Technical Specification is proposed for deletion. This Technical Specification assures that the containment airlocks remain operable to provide containment isolation. Containment isolation is maintained as a contamination barrier for the residual contamination which resides inside the containment. The RPP and its associated implementing procedures will maintain control of residual contamination inside containment. The airlocks are designed as a double-door system with one of the doors always closed during routine entry into the containment. There are situations when it is necessary to open both doors of an air lock assembly simultaneously such as removing large items from the containment or providing access to containment for large machines or components. Typically, both airlock doors would be open only for the period of time necessary to complete the relevant activity. The RPP and associated implementing procedures will specify the requirements necessary to perform this evolution to ensure occupational dose remains ALARA and below the occupational dose limits in 10 CFR Part 20 during Phase 1a. No major decommissioning activities will occur during Phase 1a. The Phase 1a condition is a continuation of the PDMS condition. While in Phase 1a, TMI-2 Solutions complies with the PDMS TS as revised by the issuance of the License Transfer Amendment which was approved by the NRC in Reference 23. Following Phase 1a, TMI-2 will enter Phase 1b and Phase 2. During Phase 1b and Phase 2, major decommissioning activities operations as defined in 10 CFR 50.2 will be performed.

	In Phase 1b and Phase 2 procedures will be employed to control containment access. Airborne radiation monitoring will be provided to monitor containment openings for airborne radioactivity. The containment airlocks used as a means of containment access will no longer be credited for maintaining containment isolation as required in PDMS. As discussed in Section 2, an analysis has been performed of a HIC fire occurring outside of containment, which represents the most limiting accident to occur in Phase 1b relative to dose at the site boundary. The results of the analysis verify the plant EAB and LPZ meet the 10 CFR 100.11 dose criteria as well as the EPA PAG criteria; below which off-site emergency response capabilities are not required. The analysis further demonstrates that the radiological consequences of the HIC fire bound the dose at the site boundary due to fire inside containment with the RB ventilation and purge system in operation. The dose analysis associated with the HIC fire does not take credit for mitigating SSC's. The dose associated with the volume of containment atmosphere released to the environs via airlock openings in Phase 1b with or without RB ventilation and purge system operating is significantly less than the dose associated with the HIC fire. Therefore, it is concluded that the results of the analysis for the HIC fire outside of containment bounds any release from an open airlock. The opening and closing of the containment airlocks will be controlled by the RPP. The RPP will identify the controls that will be implemented through procedures during D&D activities occurring inside of the RB. Implementation of these procedures take into account detailed work planning, and execution of the D&D work and support activities, as well as measures to maintain occupational dose As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning.

	Limiting Condition for PDMS 3.1.1.3 and associated Surveillance Requirement 4.1.1.3 are proposed for deletion upon entry into Phase 1b and Phase 2. The RPP and associated implementing procedures will provide control of residual contamination at the airlock. Procedures are utilized to control routine containment access via the air lock openings. Airborne radiation monitoring at the containment openings is provided. The dose at the site boundary from the HIC fire bounds any release to the environment from an open airlock. Therefore, TS 3.1.1.3 and associated surveillance requirement 4.1.1.3 are no longer required.

TS SECTION 3/4.2-REACTOR VESSEL FUEL

TS Section 3/4.2 contains Limiting Conditions for PDMS to assure that no more than 42 kg of fuel (i.e., UO_2) may be removed from the Reactor Vessel (RV) without prior NRC approval and that no more than 42 kg of fuel in the RV may be rearranged outside the geometries analyzed in the Defueling Completion Report (Reference 24) and the criticality safety analyses as discussed in Reference 25.

The Safe Fuel Mass Limit (SFML) in the Reactor Vessel (RV) was determined to be 93 kg of core debris. Based on past industry practice, a limit of approximately 45% of the SFML was placed on the amount of debris material that may be removed from the RV or rearranged in the RV. This limit is specified to ensure subcriticality even after dual errors.

Calculation TMI2-EN-RPT-0001 "Determination of the Safe Fuel Mass Limit for Decommissioning TMI-2," which is presented as Attachment 5 provides the basis to increase the SFML from 42 kg to 1200 kg. This calculation demonstrates that the remaining core debris material cannot be configured into an arrangement whereby a criticality event is possible.

TS section 3/4.2 is proposed for deletion in its entirety. This TS does not apply to TMI-2 while in Phase 1b and Phase 2.

Current TMI-2 TS	Basis for Deletion
3/4.2-Reactor Vessel Fuel	Calculation TMI2-EN-RPT-0001 "Determination of the Safe Fuel Mass Limit for Decommissioning TMI-2," has been prepared and provides the basis to increase the SFML from 42 kg to 1200 kg. The results of this calculation demonstrate that the core debris cannot be configured into an arrangement whereby a criticality event is possible. A copy of the calculation is presented in Attachment 5.

	Development of the SFML includes optimization of parameters for maximum moderation, reflection and interaction conditions in a bounding geometry. The derived SFML bounds the entire expected fissile mass inventory throughout all physically separated areas within the reactor building. It is not logistically possible for the entire mass of the RV, which is deposited in a large area, to be removed at one time. Nor is it possible for the entire mass associated with the RV to be placed into a single transportable storage container (TSC). The nature of segmentation operations separate and reduce the amount of fissile material in a single area and subsequently into any TSC. It is estimated that approximately 12-14 TSCs are necessary to pack the reactor components and internals when they are packed efficiently. Procedures will be implemented to prevent stockpiling of core debris removed from the RV in one location prior to placement into a TSC. The above discussion demonstrates that it is not credible for all the remaining fuel material to be collocated and for the resulting mass to exceed the determined 1200 kg U (1361 UO_2) SFML. It is further not considered credible that the segmentation operations would result in the fuel material being placed in an optimal physical arrangement that maximizes reactivity. All credible operational upset conditions associated with the remaining fuel in the facility are bounded such that a criticality accident during decommissioning operations is not credible. Therefore, TS 3/4.2 is proposed for deletion.

TS SECTION 3/4.3-CRANE OPERATIONS

TS Section 3/4.3 contains a Limiting Condition for PDMS to assure that loads in excess of 50,000 lbs. are prohibited from travel over the Reactor Vessel (RV) unless a docketed safety evaluation for the activity is approved by the NRC. This is to preclude a load drop into the RV that may cause reconfiguration of the core debris outside the analyzed geometries used in the "Defueling Completion Report" (Reference 24) and the criticality safety analysis as discussed in Reference 25.

TS section 3/4.3 is proposed for deletion in its entirety.

Current TMI-2 TS	Basis for Deletion
3/4.3 Crane Operations	This Technical Specification is proposed for deletion. No major decommissioning will occur during Phase 1a. The Phase 1a condition is a continuation of the PDMS condition. While in Phase 1a, TMI-2 Solutions complies with the PDMS TS as revised by the issuance of the License Transfer Amendment which was approved by the NRC in Reference 23. Following Phase 1a, TMI-2 will enter Phase 1b and Phase 2. During Phase 1b and Phase 2, major decommissioning activities as defined in 10 CFR 50.2 will be performed. The PDMS TS requirements associated with TS 3/4.3 "Crane Operations," are not applicable in Phase 1b and Phase 2. TS 3/4.3 does not satisfy any of the four requirements established in 10 CFR 50.36(c)(2)(ii) based upon the evaluation provided in Section 3.1 "Applicable Regulatory Requirements". **Criterion 1** 10 CFR 50.36(c)(2)(ii)(A) states that TS limiting conditions for operation must be established for "installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary." TMI-2 does not have a reactor coolant pressure boundary; therefore, the requirements of Criterion 1 of 10 CFR 50.36(c)(2)(ii)(A) are not applicable. **Criterion 2** 10 CFR 50.36(c)(2)(ii)(B) states that TS limiting conditions for operation must be established for a "process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier." TMI-2 is no longer licensed to operate, therefore the

	requirements of Criterion 2 of 10 CFR 50.36(c)(2)(ii)(B) are not applicable. **<u>Criterion 3</u>** The requirements of Criterion 3 of 10 CFR 50.36(c)(2)(ii)(C) states that Technical Specification limiting conditions for operation must be established for "A SSC that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier." The TMI-2 cranes do not provide a function required to mitigate the effect of unanticipated occurrences such as the fire in containment or a HIC fire as described in Section 2 "Detailed Description And Basis For The Changes." **<u>Criterion 4</u>** The requirements of Criterion 4 of 10 CFR 50.36(c)(2)(ii)(D) states that TS limiting conditions for operation must be established for "A SSC which operating experience or probabilistic risk assessment has shown to be significant to public health and safety." The intent of this criterion is that risk insights and operating experience be factored into the establishment of TS LCOs. There are no TS associated with Phase 1b or Phase 2, hence there are no limiting conditions for operation. However, TMI-2 has a procedure that provides a methodology for gathering OPEX/LL information from various sources for systematic review, evaluation, and use on the TMI-2 project. Since the containment fire analysis does not credit containment closure and assumes a release to the environment, which is bounded by the results of the HIC fire analysis, the requirements of Criterion 4 of 10 CFR 50.36(c)(2)(ii)(D) are not applicable. To provide a high degree of assurance that a load drop into the reactor vessel will not occur TMI-2 Solutions will develop a hoisting and rigging program that addresses movement of loads at TMI-

	2. The purpose of the hoisting and rigging program is to define the minimum requirements for the safe operations of cranes and hoists. The hoisting and rigging program will provide detailed requirements for training and qualification of personnel, inspection and maintenance of cranes or hoists, the safe use of rigging equipment as well as documentation for Non-Standard Lifts. A Non-Standard Lift has characteristics that require additional planning and performance efforts to ensure that the lift is performed in a safe manner. A lift plan will be developed for all Non-Standard lifts as directed by the hoisting and rigging program. Implementation of the hoisting and rigging program provides a defense in depth approach to preventing a load drop from occurring. Crane design features such as load cells, and travel stops, will be employed as required in order to ensure safe travel paths. Steel plates and barriers will be provided as required by the lift plan to preclude the effects of a load drop. In addition to the above, a calculation (Attachment 5) has been performed that assesses increasing the Safe Fuel Mass Limit (SFML) from 42 kg to approximately 1200 kg. All credible operational upset conditions associated with the remaining fuel in the facility are bounded such that a criticality accident during decommissioning operations is not credible. The attributes of the hoisting and rigging program, and lift plan, coupled with the results of the criticality analysis provided in Attachment 5 ensure that crane operations at TMI-2 can be performed safely. Therefore, Technical Specification 3/4.3 is proposed for deletion.

TS SECTION 3/4.4-SEALED SOURCES

TS Section 3/4.4 contains Limiting Condition for PDMS to assure that each sealed source containing radioactive material either in excess of 100 microcuries of beta and/or gamma emitting material or 5 microcuries of alpha emitting material (except as noted in surveillance requirement 4.4.1.2) are free of ≥0.005 microcuries of removable contamination. The limitation on removable contamination for sources requiring leak testing, including alpha emitters, is based on 10 CFR 70.39(c) limits for plutonium. This limitation will ensure that leakage from byproduct, source, and Special Nuclear Material sources will not exceed allowable intake values. The TMI-2 sealed sources are maintained at TMI-1 and managed by Exelon under a program compliant with the requirements of 10 CFR 70.39(c).

TS section 3/4.4 is proposed for relocation to the DQAP.

Current TMI-2 TS	Basis for Deletion
<u>3/4.4 Sealed Sources</u>	This Technical Specification is proposed for deletion. Section 50.36 of 10 CFR provides four criteria to define the scope of equipment and parameters to be included in the TS. Each of these criteria are addressed below. TS 3/4.4 does not satisfy any of the four requirements established in 10 CFR 50.36(c)(2)(ii) based upon the evaluation provided in Section 3.1. **<u>Criterion 1</u>** 10 CFR 50.36(c)(2)(ii)(A) states that TS limiting conditions for operation must be established for "installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary." TMI-2 does not have a reactor coolant pressure boundary; therefore, the requirements of Criterion 1 of 10 CFR 50.36(c)(2)(ii)(A) are not applicable. **<u>Criterion 2</u>** 10 CFR 50.36(c)(2)(ii)(B) states that TS limiting conditions for operation must be established for a "process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier." TMI-2 is no longer licensed to operate, therefore the requirements of Criterion 2 of 10 CFR 50.36(c)(2)(ii)(B) are not applicable. **<u>Criterion 3</u>** The requirements of Criterion 3 of 10 CFR 50.36(c)(2)(ii)(C) states that Technical Specification

	limiting conditions for operation must be established for "A SSC that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier." Sealed sources do not provide a function required to mitigate the effect of unanticipated occurrences such as the fire in containment and HIC fire as described in Section 2 "Detailed Description And Basis For The Changes." Thus, the requirements of 10 CFR 50.36(c)(2)(ii)(C) do not apply. **<u>Criterion 4</u>** The requirements of Criterion 4 of 10 CFR 50.36(c)(2)(ii)(D) states that TS limiting conditions for operation must be established for "A SSC which operating experience or probabilistic risk assessment has shown to be significant to public health and safety." The intent of this criterion is that risk insights and operating experience be factored into the establishment of TS LCOs. There are no TS associated with Phase 1b or Phase 2, hence there are no limiting conditions for PDMS. However, TMI-2 has a procedure that provides a methodology for gathering OPEX/LL information from various sources for systematic review, evaluation, and use on the TMI-2 project. Since the containment fire analysis does not credit containment closure and assumes a release to the environment, which is bounded by the results of the HIC fire analysis, the requirements of Criterion 4 of 10 CFR 50.36(c)(2)(ii)(D) are not applicable. Therefore, the requirements of Technical Specification 3/4.4 are deleted from the TS and controlled under a program which meets the requirements of 10 CFR 70.39(c) and will be subject to 10 CFR 50.59 change evaluation process that ensures adequate regulatory controls are in place.

TS SECTION 5.0 DESIGN FEATURES

TS Section 5.0 "Design Features," contains design parameters related to the containment configuration. This information is being proposed for deletion.

Current TMI-2 TS	Proposed TMI-2 TS
5.1 CONTAINMENT CONFIGURATION	This section is proposed for deletion in its entirety.

Basis

TS Section 5.1 "Containment, Configuration" identifies principal design parameters associated with a robust containment structure designed to accommodate pressurization.

During PDMS, containment isolation is maintained to assure the containment is properly maintained as a contamination barrier for the residual contamination which resides inside the containment. Phase 1a is a continuation of the PDMS condition.

Following Phase 1a, TMI-2 will enter Phase 1b and Phase 2. During Phase 1b and Phase 2, major decommissioning activities as defined in 10 CFR 50.2 will be performed. Control of residual contamination inside of containment will be provided by the Radiation Protection Program (RPP) and through implementation of procedures which address execution of D&D work and support activities, personnel safety as well as measures to maintain occupational dose ALARA and below the occupational dose limits in 10 CFR Part 20 during decommissioning as applicable.

In support of D&D, engineered access openings in the RB basement and at the RB equipment hatch will be constructed. Control of residual contamination at the containment access openings will be provided by the RPP and implementing procedures. Airborne radiation monitoring will be provided at the containment openings. Furthermore, the dose at the site boundary associated with the HIC fire as discussed in Section 2 "Detailed Description And Basis For The Changes," does not exceed the requirements of 10 CFR 100.11 and the EPA PAGs.

10 CFR 50.36 describes the design features to be included in Technical Specifications, as those features of the facility, such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety. As described in the justification for deleting containment related Limiting Conditions for PDMS and Surveillance Requirements, the worst-case accident at TMI-2 will not have a significant effect on safety. Additionally, this same information can be found in the PDMS SAR.

Therefore, the containment design features presented in TS Section 5.0 are proposed for deletion.

TS SECTION 6.0 ADMINISTRATIVE CONTROLS

The existing TS Section 6.0 Administrative Controls contains provisions relating to organization and management, procedures, recordkeeping, review and audit, programs, and reporting necessary to assure operation of the facility in a safe manner.

NRC Administrative Letter 95-06 (Reference 6) provides a discussion concerning the relocation of Technical Specification administrative controls to a Quality Assurance (QA) program. The NRC considers relocating certain TS Administrative Controls to a licensee QA program acceptable because of the controls imposed by Appendix B to 10 CFR Part 50, the existence of an NRC approved QA program, and the quality assurance program change control process as presented in 10 CFR 50.54(a). After these administrative controls are incorporated into the TMI-2 DQAP, any future changes are controlled in accordance with 10 CFR 50.54(a).

Several of the TS Section 6.0 Administrative Controls are no longer applicable in Phase 1 and Phase 2 and are being proposed for deletion.

Current TMI-2 TS	**Proposed TMI-2 TS**
6.0 ADMINISTRATIVE CONTROLS 6.1 RESPONSIBILITY 6.1.1 The TMI-2 Solutions, LLC Project Director is responsible for the management of overall unit operations at Unit 2 and shall delegate in writing the succession to this responsibility during absence.	6.0 ADMINISTRATIVE CONTROLS 6.1 RESPONSIBILITY 6.1.1 The TMI-2 Solutions, LLC Project Director is responsible for the management of overall ~~unit~~ ***facility*** operations at Unit 2 and shall delegate in writing the succession to this responsibility during absence.

Basis

The proposed change is to delete this TS section from the current TS as revised and relocate it to the DQAP.

TS Sections 6.1.1 provides a description and requirements regarding certain key operational management responsibilities. Relocating this TS to the DQAP does not change any requirements, qualifications, or responsibilities of the individual in this position, and is strictly an administrative change.

TS 6.1.1 deletes "unit" and replaces it with "facility." The term "unit," is typically associated with an operating reactor.

Administrative Controls, TS Section 6.1 will be relocated as revised to the DQAP. NRC Administrative Letter 95-06 (Reference 6) provides a discussion concerning the

<table>
<tr><td colspan="2">relocation of Technical Specification administrative controls to a quality assurance (QA) program. The NRC considers relocating these requirements to the quality assurance program acceptable because of the controls imposed by 10 CFR Part 50 Appendix B, the existence of an NRC approved quality assurance program, and the quality assurance program change control process in 10 CFR 50.54(a). After these administrative controls are incorporated into the DQAP, any future changes are controlled in accordance with 10 CFR 50.54(a). Providing the requirements for facility staff qualifications in the DQAP is considered similar in nature to the NRC observations provided in Administrative Letter 95-06, therefore the proposed relocation is acceptable.</td></tr>
<tr><td>6.2 <u>ORGANIZATION</u>

<u>TMI-2 SOLUTIONS ORGANIZATION</u>

6.2.1 The TMI-2 Solutions, LLC organization for unit management and technical support shall be as in Section 10.5 of the PDMS SAR.

<u>TMI-2 SOLUTIONS UNIT ORGANIZATION</u>

6.2.2 The unit organization shall be as described in Section 10.5 of the PDMS SAR and an individual qualified in radiation protection procedures shall be on site whenever Radioactive Waste Management activities are in progress.</td><td>6.2 <u>ORGANIZATION</u>

DELETED

<u>TMI-2 SOLUTIONS ~~UNIT~~ FACILITY ORGANIZATION</u>

6.2.2 A~~n~~ individual qualified in radiation protection procedures shall be on site whenever Radioactive Waste Management activities are in progress.</td></tr>
<tr><td colspan="2" align="center">Basis</td></tr>
<tr><td colspan="2">The proposed change is to delete this TS section from the current TS as revised and relocate it to the DQAP. The following text changes are proposed.

TS 6.2.1 is deleted to reflect that the information pertaining to "TMI-2 Solutions Facility Organization" will be conveyed in the DQAP and need not refer back to the PDMS SAR.

TS 6.2.2 is revised to reflect that the information pertaining to "TMI-2 Solutions Organization" will be conveyed in the DQAP and need not refer back to the PDMS SAR.

TS 6.2.2 deletes "UNIT" and replaces it with "FACILITY." The term "unit," is typically associated with an operating reactor.

TS Section 6.2 provides a general discussion of the TMI-2 organization which has been established to assure safe facility operations. Relocating TS Section 6.2 is</td></tr>
</table>

<table>
<tr><td colspan="2">considered administrative and similar in nature to the NRC observations provided in Administrative Letter 95-06. Therefore, the proposed deletion of TS 6.2.1 and relocation of TS 6.2.2 to the DQAP are acceptable.</td></tr>
<tr><td>6.3 <u>UNIT STAFF QUALIFICATIONS</u>

6.3.1 Each member of the unit staff shall meet or exceed the minimum qualifications of ANSI N18.1-1971 for comparable positions unless otherwise noted in the Technical Specifications. The requirements of ANSI N18.1-1971 that pertain to operator license qualifications for unit staff shall not apply.

6.3.2 The management position responsible for radiological control or his deputy shall meet or exceed the qualifications of Regulatory Guide 1.8 of 1977. Each Radiological Controls Technician in a responsible position shall meet or exceed the qualifications of ANSI N18.1-1971, paragraph 4.5.2 or 4.3.2, or be formally qualified through an NRC-approved TMI Radiation Controls training program. All Radiological Controls Technicians will be qualified through training and examination in each area or specific task related to their radiological controls functions prior to their performance of those tasks.</td><td>6.3 <u>~~UNIT~~ FACILITY STAFF QUALIFICATIONS</u>

6.3.1 Each member of the ~~unit~~ facility staff shall meet or exceed the minimum qualifications of ANSI N18.1-1971 for comparable positions unless otherwise noted in the Technical Specifications. The requirements of ANSI N18.1-1971 that pertain to operator license qualifications for ~~unit~~ facility staff shall not apply.

DELETED</td></tr>
<tr><td colspan="2">Basis</td></tr>
<tr><td colspan="2">The proposed change is to delete this TS section as revised from the current TMI-2 TS and relocate it to the DQAP. The following text changes are proposed.

TS 6.3.1 deletes "UNIT" and replaces it with "FACILITY." The term "unit," is typically associated with an operating reactor. TS Section 6.3.2 is deleted and relocated to the DQAP.

Administrative Controls TS Sections 6.3.1 and 6.3.2 will be relocated to the DQAP. NRC Administrative Letter 95-06 (Reference 6) provides a discussion concerning the relocation of Technical Specification administrative controls to a quality assurance</td></tr>
</table>

<table>
<tr><td colspan="2">(QA) program. The NRC considers relocating these requirements to the quality assurance program acceptable because of the controls imposed by 10 CFR Part 50 Appendix B, the existence of an NRC approved quality assurance program, and the quality assurance program change control process in 10 CFR 50.54(a). After these administrative controls are incorporated into the DQAP, any future changes are controlled in accordance with 10 CFR 50.54(a). Providing the requirements for facility staff qualifications in the DQAP is considered similar in nature to the NRC observations provided in Administrative Letter 95-06, therefore the proposed relocation is acceptable.</td></tr>
<tr><td>6.6 <u>REPORTABLE EVENT ACTION</u>

6.6.1 The following actions shall be taken for REPORTABLE EVENTS:

a. The Nuclear Regulatory Commission shall be notified and/or a report submitted pursuant to the requirements of Section 50.73 to 10 CFR 50.</td><td>

DELETED</td></tr>
<tr><td colspan="2">Basis</td></tr>
<tr><td colspan="2">The proposed change is to delete TS Section 6.6 from the current TS.

This section specifies that Licensee Event Reports (LER) shall be submitted pursuant to the requirements of 10 CFR 50.73. The actions of this section are required by regulation; it is not necessary to restate the requirements in the Technical Specifications. Therefore, the proposed deletion of this TS is acceptable.</td></tr>
<tr><td>6.7 <u>PROCEDURES AND PROGRAMS</u>

6.7.1 Written procedures shall be established, implemented, and maintained for the activities necessary to maintain the PDMS condition as described in the PDMS SAR. Examples of these activities are:
a. Technical Specification implementation.
b. Radioactive waste management and shipment.
c. Radiation Protection Plan Implementation.
d. Fire Protection Program implementation.
e. Flood Protection Program implementation.</td><td>6.7 <u>PROCEDURES AND PROGRAMS</u>

6.7.1 Written procedures shall be established, implemented, and maintained for the activities to be performed in Phase 1b and Phase 2. ~~necessary to maintain the PDMS condition as described in the PDMS SAR.~~ Examples of these activities are:
a. Technical Specification implementation.
b. Radioactive waste management and shipment.
c. Radiation Protection Plan Implementation.
d. Fire Protection Program implementation.</td></tr>
</table>

	e. Flood Protection Program implementation.
6.7.2 Each procedure required by Section 6.7.1, and SUBSTANTIVE CHANGES thereto, shall be reviewed and approved prior to implementation and shall be reviewed periodically as follows: a. At least every two years, the group responsible for Quality Assurance will assess a representative sample of plant procedures that are used more frequently than every two years. b. Plant procedures that have been used at least biennially receive scrutiny by individuals knowledgeable in procedures,and are updated as necessary to ensure adequacy during suitable controlled activities. c. Plant procedures that have not been used for two years will be reviewed before use or biennially to determine if changes are necessary or desirable.	6.7.2 ***DELETED***
6.7.3 Temporary changes to procedures in Section 6.7.1 above may be made provided: a. The intent of the original procedures is not altered; b. The change is approved by two members of the responsible organization knowledgeable in the area affected by the procedure. For changes which may affect the operational status of unit systems or	6.7.3 Temporary changes to procedures in Section 6.7.1 above may be made provided: a. The intent of the original procedures is not altered; b. The change is approved by two members of the responsible organization knowledgeable in the area affected by the procedure. For changes which may affect the operational status of ~~unit~~ ***facility*** systems or

equipment, at least one of these individuals shall be a member of unit management or supervision; and c. The change is documented, reviewed and approved within 14 days of implementation.	equipment, at least one of these individuals shall be a member of ~~unit~~ ***facility*** management or supervision; and c. The change is documented, reviewed and approved within 14 days of implementation.
6.7.4 The following programs shall be established, implemented, and maintained:	6.7.4 The following programs shall be established, implemented, and maintained:
a. <u>Radioactive Effluent Controls Program</u>	a. <u>Radioactive Effluent Controls Program</u>
A program shall be provided conforming with 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to MEMBERS OF THE PUBLIC from radioactive effluents as low as reasonably achievable. The program shall be contained in the ODCM, (2) shall be implemented by operating procedures, and (3) shall include remedial actions to be taken whenever the program limits are exceeded. The program shall include the following elements:	A program shall be provided conforming with 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to ***members of the public*** ~~MEMBERS OF THE PUBLIC~~ from radioactive effluents as low as reasonably achievable. The program shall be contained in the ODCM, (2) shall be implemented by operating procedures, and (3) shall include remedial actions to be taken whenever the program limits are exceeded. The program shall include the following elements:
1. Limitations on the operability of radioactive liquid and gaseous monitoring instrumentation including surveillance tests and setpoint determination in accordance with the methodology in the ODCM,	1. Limitations on the operability of radioactive liquid and gaseous monitoring instrumentation including surveillance tests and setpoint determination in accordance with the methodology in the ODCM,
2. Limitations on the concentrations of radioactive material released in liquid	2. Limitations on the concentrations of radioactive material released in liquid effluents to ~~UNRESTRICTED~~

effluents to UNRESTRICTED AREAS conforming to 10 times the concentrations specified in 10 CFR Part 20.1001 – 20.2402, Appendix B, Table 2, Column 2,	~~AREAS~~ ***unrestricted area*** conforming to 10 times the concentrations specified in 10 CFR Part 20.1001 – 20.2402, Appendix B, Table 2, Column 2,
3. Monitoring, sampling, and analysis of radioactive liquid and gaseous effluents in accordance with 10 CFR 20.1302 and with the methodology and parameters in the ODCM,	3. Monitoring, sampling, and analysis of radioactive liquid and gaseous effluents in accordance with 10 CFR 20.1302 and with the methodology and parameters in the ODCM,
4. Limitations on the annual and quarterly doses or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from the unit to the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,	4. Limitations on the annual and quarterly doses or dose commitment to a ~~MEMBER OF THE PUBLIC~~ ***member of the public*** from radioactive materials in liquid effluents released from the ~~unit~~ ***facility*** to the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,
5. Determination of cumulative and projected dose contributions from radioactive effluents for the current calendar quarter and current calendar year in accordance with the methodology and parameters in the ODCM at least every 31 days,	5. Determination of cumulative and projected dose contributions from radioactive effluents for the current calendar quarter and current calendar year in accordance with the methodology and parameters in the ODCM at least every 31 days,
6. Limitations on the operability and use of the liquid and gaseous effluent treatment systems to ensure that the appropriate systems are used to reduce releases of radioactivity when the projected doses in a 31-day period would exceed 2 percent of the guidelines for the annual dose	6. Limitations on the operability and use of the liquid and gaseous effluent treatment systems to ensure that the appropriate systems are used to reduce releases of radioactivity when the projected doses in a 31-day period would exceed 2 percent of the guidelines for the annual dose

or dose commitment conforming to Appendix I to 10 CFR Part 50,	or dose commitment conforming to Appendix I to 10 CFR Part 50,
7. Limitations on the dose rate resulting from radioactive material released in gaseous effluents to areas at or beyond the SITE BOUNDARY. The limits are as follows:	7. Limitations on the dose rate resulting from radioactive material released in gaseous effluents to areas at or beyond the SITE BOUNDARY. The limits are as follows:
a) For noble gases: less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin, and	a) For noble gases: less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin, and
b) For tritium and all radionuclides in particulate form with half lives greater than 8 days: less than or equal to 1500 mrem/yr to any organ,	b) For tritium and all radionuclides in particulate form with half lives greater than 8 days: less than or equal to 1500 mrem/yr to any organ,
8. Limitations on the annual and quarterly air doses resulting from noble gases released in gaseous effluents from the unit to areas beyond the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,	8. Limitations on the annual and quarterly air doses resulting from noble gases released in gaseous effluents from the ~~unit~~ ***facility*** to areas beyond the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,
9. Limitations on the annual and quarterly doses to a MEMBER OF THE PUBLIC from tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from each unit to areas beyond the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,	9. Limitations on the annual and quarterly doses to a ~~MEMBER OF THE PUBLIC~~ ***member of the public*** from tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from each ~~unit~~ ***facility*** to areas beyond the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,
10. Limitations on the annual dose or dose commitment to any	10. Limitations on the annual dose or dose commitment to any

MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources conforming to 40 CFR Part 190.	~~MEMBER OF THE PUBLIC~~ ***member of the public*** due to releases of radioactivity and to radiation from uranium fuel cycle sources conforming to 40 CFR Part 190.
b. <u>Radiological Environmental Monitoring Program</u>	b. <u>Radiological Environmental Monitoring Program</u>
A program will be provided to monitor the radiation and radionuclides in the environs of the plant. The program shall provide (1) representative measurements of radioactivity In the highest potential exposure pathways, and (2) verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall (1) be contained in the ODCM, (2) conform to the guidance of Appendix I to 10 CFR Part 50, and (3) Include the following:	A program will be provided to monitor the radiation and radionuclides in the environs of the plant. The program shall provide (1) representative measurements of radioactivity in the highest potential exposure pathways, and (2) verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall (1) be contained in the ODCM, (2) conform to the guidance of Appendix I to 10 CFR Part 50, and (3) Include the following:
1. Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in the ODCM.	1. Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in the ODCM.
2. A Land Use Census to ensure that changes in the use of areas at and beyond the SITE BOUNDARY identified and that modifications to the monitoring program are made if required by the results of the census, and	~~2. A Land Use Census to ensure that changes in the use of areas at and beyond the SITE BOUNDARY identified and that modifications to the monitoring program are made if required by the results of the census, and~~
3. Participation in an Interlaboratory Comparison Program to ensure that the	~~3. Participation in an Interlaboratory Comparison Program to ensure that the~~

independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.	~~independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.~~

Basis
The proposed change is to delete this TS section as revised from the current TS and relocate it to the DQAP with the exception of TS 6.7.4.b.2 which pertains to "land use census" and TS 6.7.4.b.3 which pertains to "interlaboratory comparison programs" which are proposed for deletion from the TS since they are addressed in the ODCM. The following changes are proposed. TS 6.7.1 is revised by deleting reference to the PDMS condition. The proposed TS change is applicable at the start of Phase 1b major decommissioning activities. TS 6.7.2 The proposed change is to delete this TS section from the current TS and relocate it to the DQAP. There is no text change associated with this TS. TS 6.7.3.b, 6.7.4.a.4, 6.7.4.a.8 and TS 6.7.4.a.9, deletes "unit" and replaces it with "facility." The term "unit," is typically associated with an operating reactor. TS 6.7.4.a, TS 6.7.4.a.4, TS 6.7.4.a.9 and TS 6.7.4.a.10 are revised by deleting MEMBERS OF THE PUBLIC which is a defined term in 10 CFR 20.1003, and therefore does not need to be defined in a licensee controlled document and replacing it with lower case wording. TS 6.7.4.a.2 is revised by deleting UNRESTRICTED AREAS which is a defined term in 10 CFR 20.1003, and therefore does not need to be defined in a licensee controlled document and replacing it with lower case wording. TS 6.7.4.b.2 is proposed for deletion. The land use census is currently controlled by the ODCM with report made to the NRC in the Annual Radiological Environmental Operating Report (AREOR). TS 6.7.4.b.3 is proposed for deletion. The interlaboratory comparison program is currently controlled in the ODCM which directs reports be made to the NRC in the AREOR. TS 6.7.1, 6.7.2 and 6.7.3 provides guidance relative to the establishment, implementation, maintenance and review of procedures and TS 6.7.4 provides guidance relative to the establishment, implementation, and maintenance of programs. Since these administrative requirements will be maintained in the DQAP, or in the case of TS 6.7.4.b.2 and TS 6.7.4.b.3 which will be controlled in the ODCM,

the proposed relocation of these TS requirements are considered similar in nature to the NRC observations provided in NRC Administrative Letter 95-06. Therefore, the proposed deletion and relocation are acceptable.

6.8 REPORTING REQUIREMENTS ROUTINE REPORTS 6.8.1 In addition to the applicable reporting requirements of Title 10, Code of Federal Regulations, the following reports shall be in accordance with 10 CFR 50.4 unless otherwise noted. Some of the reporting requirements of Title 10, Code of Federal Regulations are repeated below. ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT 6.8.1.1 The Annual Radiological Environmental Operating Report covering the operation of the unit during the previous calendar year shall be submitted before May 1 of each year. The report shall include summaries, interpretations, and analysis of trends of the results of the Radiological Environmental Monitoring Program for the reporting period. The material provided shall be consistent with the objectives outlined in (1) the ODCM and (2) Sections IV.B.2, IV.B.3, and IV.C of Appendix I to 10 CFR Part 50. ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT 6.8.1.2 The Annual Radiological Effluent Release Report covering the operation of the unit during the previous calendar year shall be submitted before May 1 each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste	6.8 REPORTING REQUIREMENTS ROUTINE REPORTS 6.8.1 In addition to the applicable reporting requirements of Title 10, Code of Federal Regulations, the following reports shall be in accordance with 10 CFR 50.4 unless otherwise noted. ~~Some of the reporting requirements of Title 10, Code of Federal Regulations are repeated below.~~ ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT 6.8.1.1 The Annual Radiological Environmental Operating Report covering the operation of the ~~unit~~ ***facility*** during the previous calendar year shall be submitted before May 1 of each year. The report shall include summaries, interpretations, and analysis of trends of the results of the Radiological Environmental Monitoring Program for the reporting period. The material provided shall be consistent with the objectives outlined in (1) the ODCM and (2) Sections IV.B.2, IV.B.3, and IV.C of Appendix I to 10 CFR Part 50. ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT 6.8.1.2 The Annual Radiological Effluent Release Report covering the operation of the ~~unit~~ ***facility*** during the previous calendar year shall be submitted before May 1 each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid

released from the unit. The material provided shall be (1) consistent with the objectives outlined in the ODCM and (2) in conformance with 10 CFR 50.36a and Section IV.B.1 of Appendix I to 10 CFR Part 50.	waste released from the ~~unit~~***facility***. The material provided shall be (1) consistent with the objectives outlined in the ODCM and (2) in conformance with 10 CFR 50.36a and Section IV.B.1 of Appendix I to 10 CFR Part 50.
BIENNIAL REPORTS	BIENNIAL REPORTS
6.8.1.4 Reports required on a biennial basis shall be submitted on a frequency not to exceed once every two years (24 months). The reports shall cover the activities of the unit as described below up to a minimum of 6 months prior to the date of the filing.	6.8.1.4 Reports required on a biennial basis shall be submitted on a frequency not to exceed once every two years (24 months). The reports shall cover the activities of the ~~unit~~ ***facility*** as described below up to a minimum of 6 months prior to the date of the filing.
Reports required on a biennial basis shall include:	Reports required on a biennial basis shall include:
a. All changes made to the PDMS SAR during the previous update. b. All changes, tests, or experiments meeting the requirements of 10 CFR 50.59.	a. ~~All changes made to the PDMS SAR during the previous update.~~ ***All changes to the PDMS SAR during the previous update and all changes to the Decommissioning SAR thereafter.*** b. All changes, tests, or experiments meeting the requirements of 10 CFR 50.59.
SPECIAL REPORTS	SPECIAL REPORTS
6.8.2 Special reports shall be submitted in accordance with 10 CFR 50.4 within the time period specified for each report.	***DELETED***
NONROUTINE REPORTS	NONROUTINE REPORTS
6.8.3 A report shall be submitted in the event that an Exceptional Occurrence as specified in Section 6.13 occurs. The report shall be submitted under one of the report schedules described below.	***DELETED***

PROMPT REPORTS 6.8.3.1 Those events specified as prompt report occurrences shall be reported within 24 hours by telephone, telegraph, or facsimile transmission to the NRC followed by a written report to the NRC within 30 days.	PROMPT REPORTS ***DELETED***
THIRTY DAY EVENT REPORTS 6.8.3.2 Nonroutine events not requiring a prompt report as described in Subsection 6.8.3.1, shall be reported to the NRC either within 30 days of their occurrence or within the time limit specified by the reporting requirement of the corresponding certification or permit issued pursuant to Sections 401 or 402 of PL 92-500, the Federal Water Pollution Control Act (FWPCA) Amendment of 1972, whichever time duration following the nonroutine event shall result in the earlier submittal.	THIRTY DAY EVENT REPORTS ***DELETED***
CONTENT OF NONROUTINE REPORTS 6.8.3.3 Written 30-day reports and, to the extent possible, the preliminary telephone, telegraph, or facsimile reports shall (a) describe, analyze, and evaluate the occurrence, including extent and magnitude of the impact, (b) describe the cause of the occurrence, and (c) indicate the corrective action (including any significant changes made in procedures) taken to preclude repetition of the occurrence and to prevent similar occurrences involving similar components or systems.	CONTENT OF NONROUTINE REPORTS ***DELETED***
Basis	
The proposed change is to delete this TS section from the current TS as revised and relocate it to the DQAP. The following text changes are proposed.	

TS 6.8.1; The statement "Some of the reporting requirements of Title 10, Code of Federal Regulations are repeated below" is deleted. The actions of this section are required by regulation therefore the statement being deleted is not necessary. Administrative procedures control the reporting process and detail the required actions. The rewording of the text in this paragraph is administrative and involves no technical changes to the existing TS.

TS 6.8.1.1, TS 6.8.1.2 and TS 6.8.1.4; deletes "unit" and replaces it with "facility." The term "unit," is typically associated with an operating reactor.

TS 6.8.1.4 a; this change is proposed to bring forward PDMS SAR changes which have been approved during PDMS and required to be presented in the Decommissioning SAR update as required by 10 CFR 50.71(e).

Administrative Controls TS Sections 6.8.1, 6.8.2 and 6.8.3 will be relocated to the DQAP. NRC Administrative Letter 95-06 (Reference 6) provides a discussion concerning the relocation of Technical Specification administrative controls to a quality assurance (QA) program. The NRC considers relocating these requirements to the quality assurance program acceptable because of the controls imposed by 10 CFR Part 50 Appendix B, the existence of an NRC approved quality assurance program, and the quality assurance program change control process in 10 CFR 50.54(a). After these administrative controls are incorporated into the DQAP, any future changes are controlled in accordance with 10 CFR 50.54(a). Providing the requirements for reporting in the DQAP is considered similar in nature to the NRC observations provided in Administrative Letter 95-06, therefore the proposed relocation is acceptable.

6.9 <u>RECORD RETENTION</u>	6.9 <u>RECORD RETENTION</u>
6.9.1 The following records shall be retained for at least five years: a. Records of sealed source and fission detection leak tests and results. b. Records of annual physical inventory of all sealed source material of record.	***DELETED***
6.9.2 The following records shall be retained as long as the Licensee has an NRC license to operate or possess the Three Mile Island facility.	6.9.2 The following records shall be retained as long as the Licensee has an NRC license to ~~operate or~~ possess~~.~~ ***at*** the Three Mile Island facility.

a. Records and logs of unit operation covering time interval at each power level. b. Records and logs of principal maintenance activities, inspections, repair and replacement of principal items of equipment related to nuclear safety and radioactive waste systems. c. ALL REPORTABLE EVENTS submitted to the Commission. d. Records of surveillance activities, inspections and calibrations required by these Technical Specifications. e. Records of changes made to the procedures required by Recovery Technical Specification 6.8.1 and PDMS Technical Specification 6.7.1. f. Radiation Safety Program Reports and Quarterly Recovery Progress Reports on the March 28, 1979 incident. g. Records of radioactive shipments. h. Records and logs of radioactive waste systems operations. i. Records and drawing changes reflecting facility design modifications made to systems and equipment described in the Safety Analysis Report, TER, SD, or Safety Evaluation previously submitted to NRC. j. Records of new and irradiated fuel inventory, fuel transfers	a. Records and logs of unit operation covering time interval at each power level. b. Records and logs of principal maintenance activities, inspections, repair and replacement of principal items of equipment related to nuclear safety and radioactive waste systems. c. ~~ALL REPORTABLE EVENTS~~ ***All reportable events*** submitted to the Commission. d. Records of surveillance activities, inspections and calibrations required by these Technical Specifications. e. Records of changes made to the procedures required by Technical Specification 6.8.1 and ***records of changes to programs and procedures required by*** ~~PDMS~~ Technical Specification 6.7.1. f. Radiation Safety Program Reports and Quarterly Recovery Progress Reports on the March 28, 1979 incident. g. Records of radioactive shipments. h. Records and logs of radioactive waste systems operations. i. Records and drawing changes reflecting facility design modifications made to systems and equipment described in the Safety Analysis Report, ***Technical Evaluation Report (***TER***)***, ***System Descriptions (***SD***)***, or Safety Evaluation previously submitted to NRC. j. Records of new and irradiated fuel inventory, fuel transfers

and assembly burnup histories.	and assembly burnup histories.
k. Records of transient or operational cycles for those unit components designed for a limited number of transients or cycles.	k. Records of transient or operational cycles for those unit components designed for a limited number of transients or cycles.
l. Records of reactor tests and experiments.	l. Records of reactor tests and experiments.
m. Records of training and qualification for current members of the unit staff.	m. Records of training and qualification for current members of the ~~unit~~ ***facility*** staff.
n. Records of in-service inspections previously required by the Technical Specifications.	n. Records of in-service inspections previously required by the Technical Specifications.
o. Records of Quality Assurance activities required by the Operating, Recovery, or PDMS Quality Assurance Plans.	o. Records of Quality Assurance activities required by the Operating, Recovery, or PDMS Quality Assurance Plans.
p. Records of reviews performed for changes made to procedures or equipment or reviews of tests and experiments pursuant to 10 CFR 50.59.	p. Records of reviews performed for changes made to procedures or equipment or reviews of tests and experiments pursuant to 10 CFR 50.59.
q. Records of meetings of the Plant Operation Review Committee (PORC) and the Generation Review Committee (GRC), and reports of evaluations prepared by the IOSRG, if applicable to TMI-2.	q. Records of meetings of the Plant Operation Review Committee (PORC) and the Generation Review Committee (GRC), and reports of evaluations prepared by the ***Independent Onsite Safety Review Group (***IOSRG***)***, if applicable to TMI-2.
r. Records of the incident which occurred on March 28, 1979.	r. Records of the incident which occurred on March 28, 1979.
s. Records of unit radiation and contamination surveys.	s. Records of ~~unit~~ ***facility*** radiation and contamination surveys.
t. Records of radiation exposure received by all individuals for	t. Records of radiation exposure received by all individuals for

whom monitoring was required. u. Records of gaseous and liquid radioactive material released to the environs. v. Records of reviews performed for changes made to the OFFSITE DOSE CALCULATION MANUAL.	whom monitoring was required. u. Records of gaseous and liquid radioactive material released to the environs. v. Records of reviews performed for changes made to the OFFSITE DOSE CALCULATION MANUAL

Basis

The proposed change is to delete this TS section from the current TS as revised and relocate it to the DQAP. The following text changes are proposed.

In TS Section 6.9.2, text is proposed for revision to state that TMI-2 is not licensed to operate but only to possess.

TS 6.9.2.c; The term "reportable events" is shown in capital letters which signifies this term is defined. The definition for this term is in the applicable regulations (e.g. 10 CFR 50.72 and 10 CFR 50.73); and therefore, the definition need not be repeated in the DTS.

TS 6.9.2.e is modified in order to clarify that records of changes to procedures associated with the "Recovery Technical Specifications" will be retained and that records of changes to procedures and programs as specified in PDMS TS 6.7.1 are retained.

TS 6.9.2.i; Editorial change, defined acronyms Technical Evaluation Report (TER) and System Description (SD)

TS 6.9.2.m and 6.9.2.s; deletes "unit" and replaces it with "facility." The term "unit," is typically associated with an operating reactor.

TS 6.9.2.q; Editorial changes are proposed to clarify that the records associated with the Generation Review Committee (GRC), and Independent Onsite Safety Review Group (IOSRG), as applicable to TMI-2 will be retained.

The requirements for Record Retention are proposed to be deleted from the current TS on the basis that they can be adequately addressed by the Quality Assurance Program (10 CFR 50, Appendix B, Criterion XVII) and because provisions relating to record keeping do not assure safe operation of a facility in a permanently defueled condition.

Facility operations are performed in accordance with approved written procedures. Facility records document appropriate station activities. Retention of the records provides document retrievability for review of compliance with requirements and regulations. Post compliance review of records does not assure operation of the facility in a safe manner as activities described in these documents have already been performed. Numerous other regulations such as 10 CFR 20, Subpart L, and 10 CFR 50.71 also require retention of certain records related to the facility. Thus, record retention will be maintained by the (DQAP).

Since these administrative requirements will be maintained in the DQAP, the proposed relocation of the requirements is consistent with NRC Administrative Letter 95-06. Therefore, the proposed deletion and relocation are acceptable.

6.10 RADIATION PROTECTION PROGRAM Procedures for personnel radiation protection shall be prepared consistent with the requirements of 10 CFR Part 20 and shall be approved, maintained, and adhered to for all operations involving personnel radiation exposure.	6.10 RADIATION PROTECTION PROGRAM ***DELETED***

Basis

The proposed change is to delete this section from the current TS and relocate it to the DQAP. There is no text change associated with this TS.

The "Radiation Protection Program" requires procedures to be prepared for personnel radiation protection consistent with the requirements of 10 CFR 20. These procedures are developed to ensure nuclear plant personnel safety and have no impact on nuclear safety. Additionally, nuclear plant personnel are not "members of the public." Thus, the principal operative standard in Section 182a of the Atomic Energy Act: "health and safety of the public" does not apply.

The "Radiation Protection Program" administrative controls are proposed to be deleted from the current TS. The requirement to have procedures to implement Part 20 and the requirement for periodic review of these procedures is addressed under 10 CFR 20 Subpart B – "Radiation Protection Programs."

Since the administrative requirements will be maintained in the DQAP, the proposed relocation of the requirements is considered similar in nature to the NRC observations provided in NRC Administrative Letter 95-06. Therefore, the proposed deletion and relocation are acceptable.

6.11 HIGH RADIATION AREA 6.11.1 In lieu of the "control device" or "alarm signal" required by paragraph 20.1601 of 10 CFR 20: a. Each High Radiation Area in which the intensity of radiation at	6.11 HIGH RADIATION AREA ***Pursuant to 10 CFR Part 20, paragraph 20.1601 (c), In lieu of the requirements of paragraph 20.1601(a) and 20.1601(b) of 10 CFR Part 20:***

30 cm (11.8 in.) is greater than 100 mrem/hr deep dose but less than 1000 mrem/hr shall be barricaded and conspicuously posted as a High Radiation Area, and personnel desiring entrance shall obtain a Radiation Work Permit (RWP). Any individual or group of individuals entering a High Radiation Area shall (a) use a continuously indicating dose rate monitoring device or (b) use a radiation dose rate integrating device which alarms at a pre-set dose level (entry into such areas with this monitoring device may be made after the dose rate level in the area has been established and personnel have been made knowledgeable of them), or (c) assure that a radiological control technician provides positive control over activities within the area and periodic radiation surveillance with a dose rate monitoring instrument. b. In addition to the requirements of specification 6.11.1.a: 1. Any area accessible to personnel where an individual could receive in any one hour a deep dose in excess of 1000 mrem at 30 cm (11.8 in.) but less than 500 rads at one meter (3.28 ft), from sources of radioactivity shall be locked or guarded to prevent unauthorized entry. The keys to these locked barricades shall be maintained under the administrative control of the respective Radiological Controls Supervisor.	***6.11.1 Access to each high radiation area, as defined in 10 CFR 20, in which an individual could receive a deep dose equivalent > 0.1 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation) shall be controlled as described below to prevent unauthorized entry.*** ***a. Each area shall be barricaded and conspicuously posted as a high radiation area. Such barricades may be opened as necessary to permit entry or exit of personnel or equipment.*** ***b. Entrance shall be controlled by requiring issuance of a Radiation Work Permit (RWP) or equivalent that includes specification of radiation dose rate in the immediate work area(s) and other appropriate radiation protection equipment and measures.*** ***c. Individuals qualified in radiation protection procedures or personnel continuously escorted by such individuals may, for the performance of their assigned duties in high radiation areas, be exempt from the preceding requirements for issuance of an RWP or equivalent provided they are otherwise following plant radiation protection procedures for entry into, exit from, and work in such high radiation areas.***

2. For individual high radiation areas where an individual could receive in any one hour a deep dose in excess of 1000 mrem at 30 cm (11.8 in.) but less than 500 rads at one meter (3.28 ft.), that are located within large areas such as reactor containment, where no enclosure exists for purposes of locking, and where no enclosure can be reasonably constructed around the individual area, that individual area shall be barricaded and conspicuously posted, and a flashing light shall be activated as a warning device. The Radiation Work Permit is not required by Radiological Controls personnel during the performance of their assigned radiation protection duties provided they are following radiological control procedures for entry into High Radiation Areas.	***d. Each individual or group of individuals permitted to enter such areas shall possess, or be accompanied by, one or more of the following:*** ***1. A radiation monitoring device that continuously indicates the radiation dose rate in the area.*** ***2. A radiation monitoring device that continuously integrates the radiation dose rate in the area and alarms when a preset setpoint is reached. Entry into high radiation areas with this monitoring device may be made after the dose rate in the area has been determined and personnel have been made knowledgeable of it.*** ***3. A radiation monitoring device that continuously transmits dose rate and cumulative dose information to a remote receiver monitored by radiation protection personnel responsible for controlling personnel radiation exposure within the area.*** ***4. An individual qualified in radiation protection procedures equipped with a radiation dose rate monitoring device. This individual shall be***

	responsible for providing positive radiation protection control over the activities within the area and shall perform periodic radiation surveillance at the frequency specified by radiation protection supervision. ***6.11.2 In addition to the requirements of Specification 6.12.1, high radiation areas in which an individual could receive a deep dose equivalent > 1.0 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation), but less than 500 rads/hour (at 1 meter from the radiation source or from any surface penetrated by the radiation) shall be provided with a locked or continuously guarded door, or gate, or equivalent to prevent unauthorized entry.*** ***a. The keys to such locked doors or gates, or equivalent, shall be administratively controlled in accordance with a program approved by the radiation protection manager.*** ***b. Doors and gates, or equivalent, shall remain locked except during periods of access by personnel under an approved RWP, or equivalent, to ensure individuals are informed of the dose rate in the immediate work areas prior to entry.***

	c. Individual high radiation areas in which an individual could receive a deep dose equivalent> 1.0 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation), accessible to personnel, that are located within larger areas where no enclosure exists to enable locking, or that are not continuously guarded, and where no lockable enclosure can be reasonably constructed around the individual area require both of the following access controls: ***1. Each area shall be barricaded and conspicuously posted.*** ***2. A flashing light shall be activated as a warning device.*** ~~6.11.1 In lieu of the "control device" or "alarm signal" required by paragraph 20.1601 of 10 CFR 20:~~ ~~a. Each High Radiation Area in which the intensity of radiation at 30 cm (11.8 in.) is greater than 100 mrem/hr deep dose but less than 1000 mrem/hr shall be barricaded and conspicuously posted as a High Radiation Area, and personnel desiring entrance shall obtain a Radiation Work Permit (RWP). Any individual or group of individuals entering a High Radiation Area shall (a) use a continuously indicating dose rate monitoring device or (b) use a radiation~~

	~~dose rate integrating device which alarms at a pre-set dose level (entry into such areas with this monitoring device may be made after the dose rate level in the area has been established and personnel have been made knowledgeable of them), or (c) assure that a radiological control technician provides positive control over activities within the area and periodic radiation surveillance with a dose rate monitoring instrument.~~ ~~b. In addition to the requirements of specification 6.11.1.a:~~ ~~1. Any area accessible to personnel where an individual could receive in any one hour a deep dose in excess of 1000 mrem at 30 cm (11.8 in.) but less than 500 rads at one meter (3.28 ft), from sources of radioactivity shall be locked or guarded to prevent unauthorized entry. The keys to these locked barricades shall be maintained under the administrative control of the respective Radiological Controls Supervisor.~~ ~~2. For individual high radiation areas where an individual could receive in any one hour a deep dose in excess of 1000 mrem at 20 cm (11.8 in.) but less than 500 rads at one meter (3.28 ft.), that are located within large areas such as reactor containment, where no enclosure exists for purposes of locking, and where no enclosure can be reasonably constructed~~

	~~around the individual area, that individual area shall be barricaded and conspicuously posted, and a flashing light shall be activated as a warning device.~~ ~~The Radiation Work Permit is not required by Radiological Controls personnel during the performance of their assigned radiation protection duties provided they are following radiological control procedures for entry into High Radiation Areas.~~
Basis	
This TS is deleted and replaced in its entirety and will reside in Administrative Controls Section 6.11 "High Radiation Area." The proposed Technical Specification change reorganizes the TS into a clear sequence and separates the TS into sections so that the subject matter is more easily recognized and understood. TS wording is revised to improve worker efficiency, increase awareness, clarify requirements, and enhance readability. The proposed TS wording is consistent with existing standard TS (STS) format (Reference 26) of using two main sections (one for high radiation areas and one for locked high radiation areas), with edits to remove redundancy and to improve clarity and readability. The TS changes proposed are consistent with those proposed by Exelon for TMI-1 (Reference 27) and approved by the NRC (Reference 28) for TMI-1.	
6.12 <u>OFFSITE DOSE CALCULATION MANUAL (ODCM)</u> SUBSTANTIVE CHANGES to the ODCM: a. Shall be documented and records of reviews performed shall be realized as required by Specification 6.9.2v. This documentation shall contain: 1. Sufficient information to support the change together with the appropriate analyses or	***DELETED***

evaluations justifying the change(s) and 2. A determination that the change will maintain the level of radioactive effluent control required by 10 CFR 20.1301, 40 CFR Part 190, 10 CFR 50.36a and Appendix I to 10 CFR Part 50 and not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations. b. Shall become effective after review and acceptance by TMI-2 Solutions, LLC Project Director. c. Shall be submitted to the Commission in the form of a complete, legible copy of the entire ODCM as part of or concurrent with the Annual Radioactive Effluent Release Report for the period of the report in which any change to the ODCM was made. Each change shall be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (e.g., month/year) the change was implemented.	

Basis
The proposed change is to delete this TS section from the current TS and relocate it to the DQAP. TS 6.12 specifies how to document, review, and approve changes to the ODCM. TMI-2 Solutions proposes to delete this requirement from the Technical Specifications and relocate it to the DQAP. This requirement will be maintained in accordance with 10 CFR 50.54(a). Since the intent of this section is to ensure that the ODCM continues to meet the requirements of 40 CFR 190, 10 CFR 20, 10 CFR 50.36(a), and 10 CFR 50, Appendix I, and since this requirement will be maintained in the DQAP, the proposed relocation of the requirement is considered similar in nature to the NRC observations provided in NRC Administrative Letter 95-06. Therefore, the proposed deletion and relocation of the requirement is acceptable.

6.13 EXCEPTIONAL OCCURRENCES	6.13 EXCEPTIONAL OCCURRENCES
UNUSUAL OR IMPORTANT ENVIRONMENTAL EVENTS 6.13.1 Any occurrence of an unusual or important event that causes or could potentially cause significant environmental impact causally related with station operation shall be recorded and reported to the NRC per Subsection 6.8.3.1. The following are examples of such events: excessive bird impaction events on cooling tower structures or meteorological towers (i.e., more than 100 in any one day); onsite plant or animal disease outbreaks; unusual mortality of any species protected by the Endangered Species Act of 1973; fish kills near or downstream of the site. EXCEEDING LIMITS OF RELEVANT PERMITS 6.13.2 Any occurrence of exceeding the limits specified in relevant permits and certificates issued by other Federal and State agencies which are reportable to the agency which issued the permit shall be reported to the NRC in accordance with the provisions of Subsection 6.8.3.2. This requirement shall apply only to topics of National Environmental Policy Act (NEPA) concern within the requirements of the Station NPDES permit as related to TMI-2 discharges.	***DELETED***

Basis
The proposed change is to delete this section from the current TS and relocate it to the DQAP. There is no text change associated with this TS.

TS 6.13.1 specifies requirements for recording and reporting an unusual or important event that causes or could potentially cause significant environmental impact in accordance with the requirements of TS 6.8.3.1. TS 6.13.2 specifies that any occurrence that exceeds limits of other Federal and State agency permits that are reportable, must also be reported to the NRC.

Since this requirement will be maintained in the DQAP, the proposed relocation of the requirement is considered similar in nature to the NRC observations provided in NRC Administrative Letter 95-06. Therefore, the proposed deletion and relocation of the requirement is acceptable.

The proposed changes are shown on the marked-up TMI-2 TS pages included as Attachment 2.

3. REGULATORY EVALUATION

3.1 Applicable Regulatory Requirements

The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met. TMI-2 Solutions has determined that the proposed changes do not require any exemptions or relief from regulatory requirements.

10 CFR 50.82 "Termination of license"

By letter dated August 14, 2012, (Reference 29) GPU Nuclear informed the NRC of the status of TMI-2 relative to the 1996 Decommissioning Rule changes, specifically related to 10 CFR 50.51, "Continuation of license," and 10 CFR 50.82, "Termination of license." The letter stated the intent to submit a Post-Shutdown Decommissioning Activities Report (PSDAR) that describes the planned decommissioning activities, schedule, cost estimates, and the environmental impacts of TMI-2 facility specific decommissioning. As noted in a letter from the NRC to GPU Nuclear dated February 13, 2013, (Reference 1) the equivalent to the certificate of cessation of operations was determined to be the NRC's issuance of TMI-2 License Amendment 45, converting the TMI-2 operating license to a possession only license. This amendment was granted on September 14, 1993 (Reference 30) and establishes that date as the date that TMI-2 is considered to have submitted certification of permanent cessation of operations.

10 CFR 50.36 "Technical specifications"

In 10 CFR 50.36, the Commission established its regulatory requirements related to the content of Technical Specifications (TS). In doing so, the Commission placed emphasis on those matters related to the prevention of accidents and mitigation of accident consequences; the Commission noted that applicants were expected to incorporate into their TS "those items that are directly related to maintaining the integrity of the physical barriers designed to contain radioactivity" (Statement of Consideration, "Technical Specification for Facility Licenses; Safety Analysis Reports," 33 FR 18610), (December 17, 1968).

Pursuant to 10 CFR 50.36, TS are required to include items in the following categories: (1) safety limits, limiting safety system settings, and limiting control settings; (2) limiting conditions for operation (LCOs); (3) surveillance requirements (SRs); (4) design features; and (5) administrative controls (6) decommissioning, (7) initial notification, and (8) written reports. However, the rule does not specify the particular requirements to be included in a plant's TS.

Section 50.36 of 10 CFR provides four criteria to define the scope of equipment and parameters to be included in the TS Limiting Condition for Operation (LCO). These criteria were developed for licenses authorizing operation (i.e. operating reactors) and focused on instrumentation to detect degradation of the reactor coolant system pressure boundary, process variables and equipment, design features, or operating restrictions that affect the integrity of fission product barriers during design bases accidents or transients. A fourth criterion refers to the use of operating experience and probabilistic risk assessment to identify and include in the TS, SSCs shown to be significant to public health and safety. These criteria were subsequently codified in changes to Section 36 of Part 50 of Title 10 of the Code of Federal Regulations (10 CFR 50.36) (60 FR 36953). A general discussion of these considerations is provided below.

Criterion 1 of 10 CFR 50.36(c)(2)(ii)(A) states that TS limiting conditions for operation must be established for "installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary." TMI-2 does not have a reactor coolant pressure boundary; therefore, this criterion is not applicable.

Criterion 2 of 10CFR 50.36(c)(2)(ii)(B) states that TS limiting conditions for operation must be established for a "process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier." The purpose of this criterion is to capture those process variables, that have initial values assumed in the design basis accident and transient analyses, and which are monitored and controlled during power operation. As long as these variables are maintained within the established values, risk to the public safety is presumed to be acceptably low. While this criterion was developed for operating reactors, there are some DBAs which continue to apply to a facility authorized only to handle, store, and possess nuclear fuel. The scope of DBAs applicable to a facility with a reactor that is permanently shut down and defueled is markedly reduced from those postulated for an operating plant. There are no DBAs or transients associated with TMI-2, 99% of the fuel has been removed from the facility and there is no reactor coolant pressure boundary. Section 2 "Detailed Description and Basis for the Changes" presents the unanticipated events analysis and the HIC fire accident which are discussed within this proposed amendment. This criterion is not applicable to TMI-2.

Criterion 3 of 10 CFR 50.36(c)(2)(ii)(C) states that Technical Specification limiting conditions for operation must be established for "A SSC that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier." The intent of this criterion is to capture into Technical Specifications only those SSCs that are part of the primary success path of a safety sequence analysis. Also captured by this criterion are those support and actuation systems that are necessary for items in the primary success path to successfully function. The primary success path of a safety sequence analysis consists of the combination and sequences of equipment needed to operate (including consideration of the single failure criterion), so that the plant response to design basis accidents and transients limits the consequences of these events to within the appropriate acceptance criteria.

There are no DBAs or transients, or safety-related SSC's at TMI-2; therefore, there are no safety sequences required to operate in response to a DBA. A fire inside of containment with the RB ventilation and purge system operating was determined to be the worst-case event to occur during Phase 1a in terms of dose at the site boundary. The dose for this event is determined to be less than the requirements of 10 CFR 100.11 and the EPA PAGs. Credible accidents were evaluated for Phase 1b and Phase 2 to determine the accident that produced the most limiting dose at the site boundary. A HIC fire was determined to be the most limiting accident. The dose at the boundary remains within the limits of 10 CFR 100.11 and the EPA PAGs. Dose at the site boundary for the HIC fire bounds the fire inside of containment with RB ventilation and purge operating and remains below regulatory limits. Additional detailed information is presented in Section 2 "Detailed Description and Basis for the Changes."

As part of the PDMS condition, which is extended to Phase 1a, a Safe Fuel Mass Limit (SFML) has been established to ensure that the amount of core debris that may be removed from the RV or rearranged in the RV does not exceed 42kg. This limit is specified to ensure subcriticality even after dual errors. A calculation is presented in Attachment 5, TMI2-EN-RPT-0001 "Determination of the Safe Fuel Mass Limit for Decommissioning TMI-2," which provides the basis to increase the SFML from 42 kg to 1200 kg. The results of this calculation demonstrate that the core debris material cannot be configured into an arrangement whereby a criticality event is possible and that in the worst-case scenarios analyzed k_{eff} remains below 0.95.

Criterion 4 of 10 CFR 50.36(c)(2)(ii)(D) states that TS limiting conditions for operation must be established for "A SSC which operating experience or probabilistic risk assessment has shown to be significant to public health and safety." The intent of this criterion is that risk insights and operating experience be factored into the establishment of TS LCOs.

There are no TS associated with Phase 1b or Phase 2, hence there are no limiting conditions for operation. However, TMI-2 has a procedure that provides a methodology for gathering OPEX/LL information from various sources for systematic review, evaluation, and use on the TMI-2 project.

Since the containment fire analysis does not credit containment closure and assumes a release to the environment, which is bounded by the results of the HIC failure analysis, the requirements of Criterion 4 of 10 CFR 50.36(c)(2)(ii)(D) are not applicable.

10 CFR 50.36(c)(5) Administrative Controls. "Administrative controls are the provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure operation of the facility in a safe manner."

The particular administrative controls to be included in the TS, therefore, are the provisions that the Commission deems essential for the safe operation of the facility that are not already covered by other regulations. Accordingly, the NRC staff determined that administrative control requirements that are not specifically required under Section

50.36(c)(5), and that are not otherwise necessary to obviate the possibility of an abnormal situation or an event giving rise to an immediate threat to the public health and safety, may be relocated to more appropriate documents (e.g. , Quality Assurance Topical Report, Technical Requirements Manual, Security Plan, or Emergency Plan), which are subject to regulatory controls.

The DQAP is a logical candidate for the relocation of administrative requirements because the controls imposed by 10 CFR 50 Appendix B, the existence of an NRC approved quality assurance program, and the established quality assurance program change control process in 10 CFR 50.54(a) are maintained.

NRC Administrative Letter (AL) 95-06 (Reference 6) "Relocation of Technical Specification Administrative Controls Related to Quality Assurance" provides guidance to licensees requesting amendments that relocate administrative controls to NRC approved quality assurance programs where changes are controlled in accordance with 10 CFR 50.54(a).

10 CFR 50.36(c)(6) Decommissioning. "This paragraph applies only to nuclear power reactor facilities that have submitted the certifications required by 10 CFR 50.82(a)(1) and to non-power reactor facilities which are not authorized to operate. Technical specifications involving safety limits, limiting safety system settings, and limiting control system settings; limiting conditions for operation; surveillance requirements; design features; and administrative controls will be developed on a case-by-case basis."

<u>10 CFR 50.48 Fire Protection</u>

NRC regulations in 10 CFR 50.48(f) states in part that licensees that have submitted the certifications required under 10 CFR 50.82(a)(1) maintain a fire protection program to address the potential for fires that could cause the release or spread of radioactive materials.

(1) The objectives of the fire protection program are to-

(i) Reasonably prevent fires from occurring;

(ii) Rapidly detect, control, and extinguish fires that do occur and that could result in a radiological hazard; and

(iii) Ensure that the risk of fire-induced radiological hazards to the public, environment and plant personnel is minimized.

(2) The licensee shall assess the fire protection program on a regular basis. The licensee shall revise the plan as appropriate throughout the various stages of facility decommissioning.

(3) The licensee may make changes to the fire protection program without NRC approval if the changes do not reduce the effectiveness of fire protection for facilities, systems, and equipment that could result in a radiological hazard, taking into account the decommissioning plant conditions and activities.

In 10 CFR 50.48(f), the NRC established the requirement for maintaining a fire protection program once a licensee has submitted the certifications required under 10 CFR 50.82(a)(1). Certifications for TMI-2 are documented in Reference 1. TMI-2 maintains a fire protection program that complies with the requirements of 10 CFR 50.48(f).

<u>10 CFR 50.51, "Continuation of license."</u>

"(b) Each license for a facility that has permanently ceased operations, continues in effect beyond the expiration date to authorize ownership and possession of the production or utilization facility, until the NRC notifies the licensee in writing that the license is terminated. During such period of continued effectiveness, the licensee shall—

> (1) Take actions necessary to decommission and decontaminate the facility and continue to maintain the facility, including, where applicable, the storage, control and maintenance of the spent fuel, in a safe condition, and
>
> (2) Conduct activities in accordance with all other restrictions applicable to the facility in accordance with the NRC regulations and the provisions of the specific 10 CFR part 50 license for the facility."

TMI-2 Solutions will continue to conduct activities in accordance with the license until the NRC notifies TMI-2 Solutions in writing that the license is terminated.

10 CFR 50.2 *"Definitions."*

"Safety-related structures, systems and components means those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:

(1) The integrity of the reactor coolant pressure boundary

(2) The capability to shut down the reactor and maintain it in a safe shutdown condition;

or

(3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in § 50.34(a)(1) or § 100.11 of this chapter, as applicable."

"*Major decommissioning activity* means, for a nuclear power reactor facility, any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components for shipment containing greater than class C waste in accordance with § 61.55 of this chapter."

TMI-2 Solutions will continue to conduct activities in accordance with the Definitions.

3.2 Precedent

The proposed changes are consistent with the intent of the license and accompanying TS issued to the following facilities that have been permanently shutdown and defueled: (1) Vermont Yankee Nuclear Power Station, for which an amendment was issued on October 7, 2015 (Reference 2); (2) Kewaunee Power Station, for which an amendment was issued on February 13, 2015 (Reference 3); (3) San Onofre Nuclear Generating Station, Units 2 and 3, for which an amendment was issued on July 17, 2015 (Reference 4); and (4) Crystal River Nuclear Plant, Unit 3, for which an amendment was issued on September 4, 2015 (Reference 5).

TMI-2 Solutions recognizes that use of precedent can reduce LAR preparation efforts and improve the overall quality of the application, minimize NRC requests for additional information (RAIs), and improve the efficiency of the regulatory review process. In this regard TMI-2 Solutions has evaluated the license amendment requests identified above and associated NRC issued amendments and safety evaluation reports from the perspective of ensuring that proposed revisions to, and deletions of, TS from the TMI-2 license are similar with those submitted by other licensees and accepted by the NRC.

3.3 No Significant Hazards Consideration (NSHC)

Pursuant to 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," TMI-2 Solutions LLC, proposes an amendment to the Possession Only License (POL) and Technical Specifications, of POL No. DPR-73 for Three Mile Island Nuclear Station, Unit 2 ("TMI-2").

This proposed LAR, upon approval, will revise the POL and the associated TS to support the transition of TMI-2 from PDMS to that of a facility undergoing decommissioning. The proposed amendment would revise the POL and TS to support Phase 1b and Phase 2 activities associated with achieving the removal of all Debris Material, its transfer to dry cask storage at an Independent Spent Fuel Storage Installation (ISFSI), or to a suitable waste storage area, and the relocation of various requirements to the TMI-2 DQAP.

As noted in letter from the NRC to GPU Nuclear dated February 13, 2013, (Reference 1) the equivalent to the certificate of cessation of operations was determined to be the NRC's issuance of TMI-2 License Amendment 45, converting the TMI-2 operating license to a possession only license. This amendment was granted on September 14, 1993 (Reference 30) and establishes that date as the date that TMI-2 is considered to have submitted certification of permanent cessation of operations.

The proposed changes to the POL and TS, for deletion or revision, are in accordance with 10 CFR 50.36(c)(1) through 10 CFR 50.36(c)(5). The proposed changes also include a renumbering of pages and sections, where appropriate, to condense and reduce the number of pages in the TS without affecting the technical content.

The existing TMI-2 TS contain Limiting Conditions for PDMS that provides the functional capability of equipment required for safe operation of the facility. The current TS are only applicable with TMI-2 in the PDMS condition. Limiting Conditions for PDMS and associated Surveillance Requirements (SRs) that will not apply in Phase 1b or Phase 2 are being proposed for deletion. The remaining portions of the TS are being proposed for revision and will continue to provide an acceptable level of control for the TMI-2 facility as it undergoes decommissioning.

TMI-2 Solutions has evaluated whether a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed amendment involve a significant Increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed changes would revise the TMI-2 POL and TS by deleting or modifying certain portions of the TS that are no longer applicable to TMI-2 as it transitions from PDMS to decommissioning. This change is consistent with the criteria set forth in 10 CFR 50.36 for the contents of TS.

The Phase 1a condition is a continuation of the PDMS condition. No major decommissioning activities will occur in Phase 1a. As discussed in Section 2 "Detailed Description and Basis for the Changes" of this proposed amendment, the radiological consequences associated with the fire inside containment, unanticipated event, does not exceed the applicable limits of 10 CFR 100.11 and the EPA PAGs.

Following Phase 1a, TMI-2 will enter Phase 1b and Phase 2. During Phase 1b and Phase 2, major decommissioning activities as defined in 10 CFR 50.2 will be performed. As discussed in Section 2, a HIC fire outside of containment has been evaluated and determined to be the accident that could occur during decommissioning that would result in a maximum dose at the site boundary. The HIC fire occurs in the open air. The release involves an unfiltered, ground level release that takes no credit for the operation of any SSCs to mitigate the consequences of the event. The HIC fire does not require the addition of new Technical Specifications. The HIC fire does not meet the definition of a DBA since there are no SSCs that are credited to mitigate the event.

During Phase 1a, containment isolation is maintained to assure the containment is properly maintained as a contamination barrier for the residual contamination which resides inside the containment.

There are no postulated accidents that can occur inside of the RB during Phase 1b or Phase 2 that result in the dose at the site boundary exceeding the limits of 10 CFR 100.11 and the EPA PAGs including such times as when the containment engineered access equipment hatch is open. The D&D process includes many evolutions that will require the equipment hatch and other RB access points to be open to allow movement of equipment, waste, and other materials into and out of the RB. The RPP will identify the controls that will be implemented through procedures during D&D activities occurring inside of the RB. Implementation of these procedures take into account detailed work planning, and execution of the D&D work and support activities, including measures to maintain occupational dose As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning.

Procedures associated with Phase 1b will be developed to retrieve the remaining core debris and decontaminate high radiation areas. Phase 2 procedures will also be developed; however, the focus of these procedures is related to performing D&D operations in a facility which has not experienced an accident.

The deletion of TS 3/4.1 does not cause a change in facility conditions, design function, or analysis that verifies the ability of SSC's to perform a design function. The function of the containment is to contain residual contamination inside the containment during decommissioning remains unchanged. During Phase 1b the RPP and associated implementing procedures will provide the controls necessary to manage residual contamination. As such the containment continues to function as a contamination barrier. Airborne radiation monitoring will be provided at the engineered containment openings. With the construction of the engineered openings in containment the RB breather no longer provides a preferred path to the atmosphere. No credit is taken for the containment as a pressure containing boundary and therefore unfiltered leak rate testing of the containment is no longer applicable.

The dose at the site boundary associated with the HIC fire bounds the dose at the site boundary associated with Phase 1b and Phase 2 and does not exceed the requirements of 10 CFR 100.11, and the EPA PAGs.

Therefore, the deletion of TS 3/4.1 "Containment" does not involve a significant increase in the probability or consequences of an accident previously evaluated.

TS 3/4.2 "Reactor Vessel Fuel" establishes a Safe Fuel Mass Limit (SFML) for the PDMS condition, which ensures that the amount of core debris that may be removed from the RV or rearranged in the RV during PDMS does not exceed 42kg. This SFML is specified to ensure subcriticality even after dual errors.

The deletion of TS 3/4.2 does not cause a change in facility conditions, design function, or analysis that verifies the ability of SSC's to perform a design function. A calculation is presented as Attachment 5, which provides the basis to increase the SFML from 42 kg to 1200 kg. The result of this calculation demonstrates that the entire mass of the core debris material cannot be configured into an arrangement whereby a criticality event is possible and that K_{eff} does not exceed 0.95.

Therefore, the deletion of TS 3/4.2 "Reactor Vessel Fuel" does not involve a significant increase in the probability or consequences of an accident previously evaluated.

In Phase 1a, TS 3/4.3 "Crane Operations" prohibits loads in excess of 50,000 lbs. from travel over the RV.

The deletion of TS 3/4.3 does not cause a change in facility conditions, design function, or analysis that verifies the ability of SSC's to perform a design function. As discussed in Section 2 "Detailed Description and Basis for The Changes," for Phase 1b and Phase 2, TMI-2 Solutions will develop a hoisting and rigging program that addresses movement of loads at TMI-2. The purpose of the hoisting and rigging program is to define the minimum requirements for the safe operations of cranes and hoists. The hoisting and rigging program will provide as applicable, detailed requirements for training and qualification of personnel, inspection and maintenance of cranes or hoists, the safe use of rigging equipment as well as direction for performing Non-Standard Lifts in order to ensure that lifting operations are performed in a safe manner. A lift plan will be developed for all lifts as directed by the hoisting and rigging program.

Implementation of the hoisting and rigging program provides a defense in depth approach to preventing a load drop from occurring. Crane design features such as load cells, and travel stops, will be employed as required to ensure safe travel paths. Steel plates and barriers will be provided as per the lift plan, as required to preclude the effects of a load drop.

A calculation has been performed (Attachment 5) that assesses increasing the Safe Fuel Mass Limit (SFML) from 42 kg to approximately 1200 kg. The analysis states that it is not credible to have 1200 kg U in an idealized configuration for criticality to occur. There are no credible operational upsets to realize the ideal configuration but even in the event that the upset occurs, it would require fissile mass in excess of that analyzed, which is greater than what is anticipated.

Therefore, the deletion of TS 3/4.3 "Crane Operations" does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The TMI-2 sealed sources are maintained at TMI-1 and managed by Exelon under a program compliant with the requirements of 10 CFR 70.39(c). Deleting TS 3/4.4 "Sealed Sources" from the TMI-2 TS and relocating the TS requirements to the DQAP does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The deletion of TS definitions and rules of usage and application that will not be applicable during Phase 1b and Phase 2 decommissioning, has no impact on facility structures, systems, and components (SSCs) or the methods of operation of such SSCs.

The proposed relocation of certain administrative requirements as allowed by Administrative Letter 95-06 (Reference 6) do not affect operating procedures or administrative controls that have the function of ensuring the safe management of Debris Material or decommissioning of the facility.

Therefore, the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?**

   Response: No.

   The proposed changes to delete and/or modify the TS does not create the possibility of a new or different kind of accident from that previously evaluated. The removal of the TS applicable in Phase 1a cannot result in different or more adverse accidents than previously evaluated because there are no new credible failure mechanisms, or accident initiators not considered in the design and licensing basis for Phase 1b.

   Following Phase 1a, TMI-2 will enter Phase 1b and Phase 2. During Phase 1b and Phase 2, major decommissioning activities as defined in 10 CFR 50.2 will be performed. As discussed in Section 2, a HIC fire has been evaluated and determined to be the accident that could occur during decommissioning that would maximize dose at the site boundary. The HIC fire occurs in the open air. The release involves an unfiltered, ground level release that takes no credit for the operation of any SSCs to mitigate the consequences of the event. The HIC fire does not impact existing TS or require the addition of new Technical Specifications. The HIC fire does not meet the definition of a DBA since there are no SSCs that are credited to mitigate the event.

   During Phase 1a, containment isolation is maintained to assure the containment is properly maintained as a contamination barrier for the residual contamination which resides inside the containment.

   There are no postulated accidents that can occur inside of the RB during Phase 1b or Phase 2 that result in the dose at the site boundary exceeding the limits of 10 CFR

100.11 and the EPA PAGs including such times as when the containment engineered access equipment hatch is open. The D&D process includes many evolutions that will require the equipment hatch and other RB access points to be open to allow movement of equipment, waste, and other materials into and out of the RB. The RPP will identify the controls that will be implemented through procedures during D&D activities occurring inside of the RB. Implementation of these procedures take into account detailed work planning, and execution of the D&D work and support activities, including measures to maintain occupational dose As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning. Procedures associated with Phase 1b will be developed to retrieve the remaining core debris and decontaminate high radiation areas. Phase 2 procedures will also be developed; however the focus of these procedures is related to performing D&D operations in a facility which has not experienced an accident.

The deletion of TS 3/4.1 "Containment" does not cause a change in facility conditions, nor does it cause a change in design function. The function of the containment is to maintain residual contamination during Phase 1a remains unchanged. During Phase 1b and 2, the RPP and associated implementing procedures will provide the controls necessary to manage residual contamination. As such, the containment continues to function as a contamination barrier. Airborne radiation monitoring will be provided at the engineered containment openings. Procedures are utilized to control routine containment access via the air lock openings. With the construction of the engineered openings in containment the RB breather no longer provides a preferred path to the atmosphere. No credit is taken for the containment as a pressure containing boundary and therefore unfiltered leak rate testing of the containment is no longer applicable.

The dose at the site boundary associated with the HIC fire, bounds the dose at the site boundary associated with the Phase 1a unanticipated event, and does not exceed the requirements of 10 CFR 100.11, as well as the EPA PAGs.

Therefore, the deletion of TS 3/4.1 "Containment" does not create the possibility of a new or different kind of accident from any accident previously evaluated relative to Phase 1b or Phase 2.

TS 3/4.2 "Reactor Vessel Fuel" establishes a Safe Fuel Mass Limit (SFML) for the PDMS condition, which ensures that the amount of core debris that may be removed from the RV or rearranged in the RV during PDMS does not exceed 42kg. This SFML limit is specified to ensure subcriticality even after dual errors.

The deletion of the TS does not cause a change in facility conditions nor does it cause a change in design function. A calculation is presented as Attachment 5, which provides the basis to increase the SFML from 42 kg to 1200 kg. The result of this calculation demonstrates that the entire mass of the core debris material cannot be configured into an arrangement whereby a criticality event is possible and that K_{eff} does not exceed 0.95.

Therefore, the deletion of TS 3/4.2 "Reactor Vessel Fuel" does not create the possibility of a new or different kind of accident from any accident previously evaluated relative to Phase 1b or Phase 2.

As part of the PDMS condition, loads in excess of 50,000 lbs. are prohibited from travel over the RV. The deletion of TS 3/4.3 "Crane Operations" does not cause a change in facility conditions nor does it cause a change in design function.

As discussed in Section 2 "Detailed Description and Basis for The Changes," for Phase 1b and Phase 2, TMI-2 Solutions will develop a hoisting and rigging program that addresses movement of loads at TMI-2. The purpose of the hoisting and rigging program is to define the minimum requirements for the safe operations of cranes and hoists. The hoisting and rigging program will provide detailed requirements as applicable for training and qualification of personnel, inspection and maintenance of cranes or hoists, the safe use of rigging equipment as well as direction for performing Non-Standard Lifts in order to ensure that lifting operations are performed in a safe manner. A lift plan will be developed for all lifts as directed by the hoisting and rigging program.

Implementation of the hoisting and rigging program provides a defense in depth approach to preventing a load drop from occurring. Crane design features such as load cells, and travel stops, will be employed as required to ensure safe travel paths. Steel plates and barriers will be provided as required to preclude the effects of a load drop.

A calculation has been performed (Attachment 5) that assesses increasing the Safe Fuel Mass Limit (SFML) from 42 kg to approximately 1200 kg. The analysis states that it is not credible to have 1200 kg U in an idealized configuration for criticality to occur. There are no credible operational upsets to realize the ideal configuration but even in the event that the upset occurs, it would require fissile mass in excess of that analyzed, which is greater than what is anticipated, in addition to a greatly reduced impurity concentration to present a criticality hazard.

Therefore, the deletion of TS 3/4.3 "Crane Operations" does not create the possibility of a new or different kind of accident from any accident previously evaluated relative to Phase 1b or Phase 2.

The TMI-2 sealed sources are maintained at TMI-1 and managed by Exelon under a program compliant with the requirements of 10 CFR 70.39(c). Deleting TS 3/4.4 "Sealed Sources" from the TMI-2 TS and relocating the TS requirements to the DQAP does not create the possibility of a new or different kind of accident from any accident previously evaluated relative to Phase 1b or Phase 2.

The proposed change will not create the possibility of a new or different kind of accident due to credible new failure mechanisms, malfunctions, or accident initiators not considered in the design and licensing bases. Decommissioning operations in Phase 1b and Phase 2 are bounded by the result of the HIC failure accident.

Therefore, the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated relative to Phase 1b or Phase 2.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No.

The proposed changes would revise the TMI-2 POL and TS by deleting or modifying certain portions of the TS that are no longer applicable to TMI-2 as it transitions from PDMS to decommissioning. This change is consistent with the criteria set forth in 10 CFR 50.36 for the contents of TS.

The Phase 1a condition is a continuation of the PDMS condition. No major decommissioning activities will occur in Phase 1a. As discussed in Section 2 "Detailed Description and Basis for the Changes" of this proposed amendment, the radiological consequences associated with the fire inside containment, unanticipated event, does not exceed the applicable limits of 10 CFR 100.11 and the EPA PAGs.

Following Phase 1a, TMI-2 will enter Phase 1b and Phase 2. During Phase 1b, major decommissioning activities as defined in 10 CFR 50.2 will be performed. As discussed in Section 2, a HIC fire has been evaluated and determined to be the accident that could occur during decommissioning that would result in a maximum dose at the site boundary. The HIC fire occurs in the open air. The release involves an unfiltered, ground level release that takes no credit for the operation of any SSCs to mitigate the consequences of the event. The HIC fire does not require the addition of new Technical Specifications. The HIC fire does not meet the definition of a DBA since there are no SSCs that are credited to mitigate the event.

During Phase 1a, containment isolation is maintained to assure the containment is properly maintained as a contamination barrier for the residual contamination which resides inside the containment.

There are no postulated accidents that can occur inside of the RB during Phase 1b or Phase 2 that result in the dose at the site boundary exceeding the limits of 10 CFR 100.11 and the EPA PAGs including such times as when the containment engineered access equipment hatch is open. The D&D process includes many evolutions that will require the equipment hatch and other RB access points to be open to allow movement of equipment, waste, and other materials into and out of the RB. The RPP will identify the controls that will be implemented through procedures during D&D activities occurring inside of the RB. Implementation of these procedures take into account detailed work planning, and execution of the D&D work and support activities, including measures to maintain occupational dose As Low As Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning. Procedures associated with Phase 1b will be developed to retrieve the remaining core debris and decontaminate high radiation areas. Phase 2 procedures will also be developed; however, the focus of these procedures is related to performing D&D operations in a facility which has not experienced an accident.

The deletion of TS 3/4.1 "Containment" does not exceed or alter a design basis or safety limit. The function of the containment which is to maintain residual contamination during Phase 1a and 2 remains unchanged. During Phase 1b the RPP and associated implementing procedures will provide the controls necessary to manage residual contamination. As such the containment continues to function as a contamination barrier. Airborne radiation monitoring will be provided at the engineered containment openings. Procedures are utilized to control routine containment access via the air lock openings. With the construction of the engineered openings in containment the RB breather no longer provides a preferred path to the atmosphere. No credit is taken for the containment as a pressure containing boundary and therefore unfiltered leak rate testing of the containment is no longer applicable. The dose at the site boundary associated with the HIC fire bounds the dose at the site boundary associated with the Phase 1a unanticipated event and does not exceed the requirements of 10 CFR 100.11 and the EPA PAGs.

Therefore, deletion of TS 3/4.1 "Containment" does not significantly reduce the margin of safety during Phase 1b and Phase 2.

TS 3/4.2 "Reactor Vessel Fuel" establishes a Safe Fuel Mass Limit (SFML) for the PDMS condition, which ensures that the amount of core debris that may be removed from the RV or rearranged in the RV during PDMS does not exceed 42kg. This SFML limit is specified to ensure subcriticality even after dual errors.

A calculation is presented as Attachment 5 which provides the basis to increase the SFML from 42 kg to 1200 kg.

The current SFML was developed based solely on credible upper bounds for input parameters as opposed to sample data or realistic conditions. The proposed revision to the SFML is based upon existing data and known conditions. These inputs are still considered to be reasonably and sufficiently conservative for their use in development of the proposed 1200 kg SFML. The derived SFML bounds the entire expected fissile mass inventory throughout all physically separated areas within the reactor building. The bounding fissile mass used to produce the SFML is assembled in idealized conditions that cannot credibly exist during decommissioning operations. Even if the expected remaining fissile mass throughout the building, including hold up in all piping and cubicles were to be brought together, a criticality is not feasible. There are no credible operational upsets to realize the ideal configuration but even in the event that the upset occurs, it would require fissile mass in excess of that analyzed, which is greater than what is anticipated. In addition, the SFML is based on a significantly reduced impurity concentration below that demonstrated to be present. The k_{eff} for the new SFML in the idealized static conditions does not exceed 0.95.

The calculation of the new SFML states that the entire mass of the core debris material cannot be configured into an arrangement whereby a criticality event is possible. Debris material removal operations will involve loading 12-14 storage casks with each cask containing less than the total SFML calculated for Phase 1b.

The overall subcritical nature, namely inherent elemental constituents, of the fuel debris remaining at the TMI-2 facility today is equivalent to that associated with the fuel debris at TMI-2 prior to defueling operations. The presence of some intact fuel, and the results of sampling campaigns conducted prior to defueling indicating slight impurity gradients through the RV did not easily allow the application of a representative fuel composition to the entirety of the core during the development of the previous SFML. Further, static and accident conditions analyzed after defueling merely credited the minimum concentration of impurities to ensure the facility was safe. In each of these scenarios, the applied conservatisms are different. Currently, most of the remainder of the fuel debris resides in the RV lower head and sampling data is available for that region. Therefore, a reasonable representative impurity concentration can be applied to the homogenized mass in development of a new SFML for D&D. A conservative approach to adequately represent the inherent characteristics of the remaining fuel debris can be taken with respect to the development of an SFML for the remaining decommissioning activities. This approach would not necessarily be applicable for the previous defueling operations or the related SFML developed at that time. The current SFML was conservatively derived and, coupled with the conservatively estimated masses and the planned decommissioning operations, provides significant and adequate margin of safety that ensures that the potential for a criticality is not credible.

The proposed change does not exceed or alter the SFML design basis as presented in the UFSAR and k_{eff} for the new SFML does not exceed 0.95. Therefore, the deletion of PDMS TS 3/4.2 "Reactor Vessel Fuel" does not involve a significant reduction in a margin of safety during Phase 1b and Phase 2.

As part of the PDMS condition, loads in excess of 50,000 lbs. are prohibited from travel over the RV.

The deletion of TS 3/4.3 does not exceed or alter a design basis or safety limit. As discussed in Section 2 "Detailed Description and Basis for The Changes," for Phase 1b and Phase 2, TMI-2 Solutions will develop a hoisting and rigging program that addresses movement of loads at TMI-2. The purpose of the hoisting and rigging program is to define the minimum requirements for the safe operations of cranes and hoists. The hoisting and rigging program will provide as applicable, detailed requirements for training and qualification of personnel, inspection and maintenance of cranes or hoists, the safe use of rigging equipment as well as direction for performing Non-Standard Lifts in order to ensure that lifting operations are performed in a safe manner. A lift plan will be developed for all lifts as directed by the hoisting and rigging program.

Implementation of the hoisting and rigging program provides a defense in depth approach to preventing a load drop from occurring. Crane design features such as load cells, and travel stops, will be employed as required to ensure safe travel paths. Steel plates and barriers will be provided as required to preclude the effects of a load drop.

A calculation has been performed Attachment 5 that assesses increasing the Safe Fuel Mass Limit (SFML) from 42 kg to approximately 1200 kg. As stated in the calculation, it is not credible to have 1200 kg U in an idealized configuration for criticality to occur. There are no credible operational upsets to realize the ideal configuration but even in the event that the upset occurs, it would require fissile mass in excess of that analyzed, which is greater than what is anticipated, in addition to a greatly reduced impurity concentration to present a criticality hazard.

Therefore, the deletion of TS 3/4.3 "Crane Operations" does not significantly reduce the margin of safety during Phase 1b and Phase 2.

The TMI-2 sealed sources are maintained at TMI-1 and managed by Exelon under a program compliant with the requirements of 10 CFR 70.39(c). Deleting TS 3/4.4 "Sealed Sources" from the TMI-2 TS and relocating the TS requirements to the DQAP does not involve a significant involve a significant reduction in a margin of safety.

The proposed changes do not affect remaining plant operations, systems, or components supporting decommissioning activities. The proposed changes do not result in a change in initial conditions, or in any other parameter affecting the course of the remaining decommissioning activity accident analysis. Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, TMI-2 Solutions concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of no significant hazards consideration is justified.

3.4 Conclusion

In conclusion, based on the considerations discussed above: 1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, 2) such activities will be conducted in compliance with the NRC's regulations, and 3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

4.0 ENVIRONMENTAL CONSIDERATION

TMI-2 Solutions has evaluated the proposed changes against the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.22. TMI-2 Solutions has determined that the proposed changes meet the criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) and 10 CFR 51.22(c)(10)) and as such, has determined that no irreversible consequences exist in accordance with 10 CFR 50.92(b). The following is provided in support of the conclusion.

(i) The proposed changes involve no significant hazards consideration.

As demonstrated in Section 3.3 of this attachment, the proposed changes do not involve an SHC.

(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released off site.

The proposed license amendment is consistent with the plant activities described in the PDMS SAR. No changes in effluent system requirements or controls are proposed in this change. The environmental impacts associated with radiation dose to members of the public related to decommissioning activities do not exceed the requirements of 10 CFR 100.11 and the EPA PAGs. Furthermore, as committed to in Reference 31, TMI-2 Solutions will issue Revision 4 to the TMI-2 "Post-Shutdown Decommissioning Activities Report (PSDAR) within 90 days of closing. PSDAR Rev. 4 addresses compliance with NUREG 0683, "Final Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from March 28, 1979 Accident Three Mile Island Nuclear Station, Unit 2 Volumes 1 and 2, March 1981" (Reference 32) and its three supplements (References 33, 34 and 35) and NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (Reference 36) relative to decommissioning activities to be performed in Phase 1b and Phase 2.

Based on the above, there will not be a significant change in the types or increase in the amounts of effluents released offsite associated with Phase 1b and Phase 2 decommissioning activities. The release of effluents from the facility will continue to be controlled by site procedures and continue to be performed in accordance with the TMI-2 Offsite Dose Calculation Manual, as applicable.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

TMI-2 Solutions will maintain annual occupational radiation exposure to individuals as low as reasonably achievable. These exposures will be at, or below, the estimated values in Table 4-1 of NUREG-0586, Supplement 1 (Reference 36).

TMI-2 Solutions will maintain exposure to onsite workers and the offsite public as a result of waste transportation well below the 100 person-rem exposure limit projected by NUREG-0586.

Based on the above, there is no significant increase in individual or cumulative occupational exposure due to decommissioning TMI-2.

Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

5.0 REFERENCES

1. Camper, L. W. (NRC) to Pace, D. L. (GPU Nuclear) letter, "Three Mile Island Nuclear Station, Unit 2 (TMI-2) – Failure to Submit Post-Shutdown Decommissioning Activities Report – Non-cited Violation (Docket: 05000320)," dated February 13, 2013 (ML12349A291).

2. Letter from U.S. Nuclear Regulatory Commission to Entergy Nuclear Operations, Inc., "Vermont Yankee Nuclear Power Station - Issuance of Amendment for Defueled Technical Specifications and Revised License Conditions for Permanently Defueled Condition (CAC No. MF3714)," dated October 7, 2015 (ML15117A551).

3. Letter from U.S. Nuclear Regulatory Commission to Dominion Energy Kewaunee, Inc., "Kewaunee Power Station - Issuance of Amendment for Permanently Shutdown and Defueled Technical Specifications and Certain License Conditions (TAC No.MF1952)," dated February 13, 2015 (ML14237A045).

4. Letter from U.S. Nuclear Regulatory Commission to Southern California Edison Company, "San Onofre Nuclear Generating Station, Units 2 and 3 – Issuance of Amendment for Permanently Shutdown and Defueled Operating License and Technical Specifications (TAC Nos. MF3774 and MF3775)," dated July 17, 2015 (ADAMS Accession No. ML15139A390).

5. Letter from U.S. Nuclear Regulatory Commission to Crystal River Nuclear Plant, "Crystal River Unit 3 Nuclear Generating Plant – Issuance of Amendment for Permanently Shutdown and Defueled Operating License and Technical Specifications (TAC No MF3089)," dated September 4, 2015 (ADAMS Accession No. ML15224B286).

6. NRC Administrative Letter 95-06, "Relocation of Technical Specification Administrative Controls Related to Quality Assurance," dated December 12, 1995 (ADAMS Legacy Library No. 9512060318).

7. NUREG/CR-2601, Addendum 1 "Technology, Safety and Costs of Decommissioning Reference Light Water Reactors following Postulated Accidents" (ML14023A051), dated December 1990 (ML14023A049).

8. Gallagher, Michael P. (Exelon Generation Company, LLC) to USNRC, "Request for Exemptions from Portions of 10 CFR 50.47 and 10 CFR Part 50, Appendix E," dated July 1, 2019 (ML19182A104).

9. 990-3017, "Three Mile Island Unit No. 2 Fire Protection Program Evaluation, Revision 12, dated May 18, 2018

10. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.183, Revision 0, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, "dated July 2000 (ML003716792).

11. SECY-20-0041, "Request by Exelon Generation Company, LLC for Exemptions from Certain Emergency Planning Requirements for the Three Mile Island Nuclear Station," dated May 5, 2020 (ML19311C763).

12. 990-3017, "Three Mile Island Unit No. 2 Fire Protection Program Evaluation, Revision 13, dated February 2, 2020.

13. "EPA-520/1-88-20, Federal Guidance Report 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factor for Inhalation, Submersion and Ingestion, September 1988".

14. EPA-402-R-93-081, Federal Guidance Report No. 12, External Exposure to Radionuclides In Air, Water, And Soil, Keith F. Eckerman and Jeffrey C. Ryman, September 1993.

15. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Post-Defueling Monitored Storage Facility Operating License No. DPR-73 GPU Nuclear Corporation Three Mile Island Nuclear Station, Unit 2 Docket No. 50-320 dated December 28, 1993 (ML20059D177).

16. Letter C311-95-2248 from Broughton, T.G. (GPU Nuclear) to USNRC, letter "Special Auxiliary and Fuel Handling Building Ventilation Study," dated June 1, 1995.

17. "NUREG/CR-0130 Volume 1 Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station June 1978".

18. NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Volumes 1 and 2, Regarding the Decommissioning of Nuclear Power Reactors," (GEIS)" dated November 2002.

19. NUREG 1864, A Pilot Probabilistic Risk Assessment Of a Dry Cask Storage System At a Nuclear Power Plan, March 2007".

20. Regulatory Guide 1.145, Rev. 1, Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants, Re-Issued February 1983 (ML003740205).

21. Regulatory Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light Water Cooled Reactors, Revision 1, July 1977 (ML003740354).

22. EPA-400/R-17/001, "PAG Manual:Protective Action Guides and Planning Guidance for Radiological Incidents," January 2017".

23. Letter from USNRC to Sauger, J. (TMI-2 Solutions, LLC), "Three Mile Island Nuclear Station, Unit No. 2 – Issuance of Amendment No. 64 Re: Order Approving Transfer of License and Conforming License Amendment (EPID L-2019-LLA-0257)," dated December 18, 2020 (ML20352A381).

24. Letter 4410-90-L-0012/0477P, from GPU Nuclear, to USNRC "Defueling Completion Report, Final Submittal," dated February 22, 1990 (ML20011F536).

25. Letter C312-92-2080, from GPU Nuclear, to USNRC "TMI-2 Reactor Vessel Criticality Safety Analysis," dated December 18, 1992 (ML20126D277).

26. NUREG 1430, Standard Technical Specifications (STS), Babcock and Wilcox Plants, Revision 4, dated April 2012.

27. Barstow, James, (Exelon Generation Company, LLC), to USNRC, "Exelon Fleet License Amendment Request - Common Language for Technical Specification High Radiation Area Administrative Controls," dated June 26, 2019 (ML19178A304).

28. Letter from U.S. Nuclear Regulatory Commission; to Hanson Bryan C. (Exelon Generation Company, LLC), Braidwood Station, Units 1 and 2; Byron Station, Unit Nos. 1 and 2; Calvert Cliffs Nuclear Power Plant, Units 1 and 2; Clinton Power Station, Unit No. 1; Dresden Nuclear Power Station, Units 2 and 3; James A. Fitzpatrick Nuclear Power Plant; Lasalle County Station, Units 1 and 2; Limerick Generating Station, Units 1 and 2; Nine Mile Point Nuclear Station, Units 1 and 2; Peach Bottom Atomic Power Station, Units 2 and 3; Quad Cities Nuclear Power Station, Units 1 and 2; R. E. Ginna Nuclear Power Plant; and Three Mile Island Nuclear Station, Unit 1 – "Issuance Of Amendments Revising The High Radiation Area Administrative Controls" (EPID L-2019-LLA-0133 AND L-2019-LLA-0134), dated July 8 2020 (ML20134H940).

29. Pace, D. L. (GPU Nuclear) to USNRC, letter "Notification of Intent to Submit a Post-Shutdown Decommissioning Activities Report," dated August 14, 2012 (ML12235A227).

30. Masnik, M. T. (NRC) to Long, R. L. (GPU Nuclear) letter, "Issuance of Amendment No. 45 for Facility Operating License No. DPR-73 to Possession Only License for Three Mile Island Nuclear Station Unit 2 (TAC No. ML69115)," dated September 14, 1993 (ML20029E535).

31. Halnon G. H. (GPU Nuclear, Inc) and van Noordennen G.P (EnergySolutions), to USNRC letter "Notification of Revision of Commitment for Amended Post-Shutdown Decommissioning Activities Report (PSDAR) for Three Mile Island, Unit 2 in Accordance with 10 CFR 50.82(a)(7)," dated March 2, 2020 (ML20066F494).

32. NUREG 0683 "Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from March 28, 1979 Accident Three Mile Island Nuclear Station, Unit 2," Volume 1 ML19343C359 and Volume 2 (ML20003C732), dated March 1981.

33. NUREG 0683 Supplement 1, "Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from March 28, 1979 Accident Three Mile Island Nuclear Station, Unit 2," (Occupational Radiation Dose), dated October 1984.

34. NUREG 0683 Supplement 2, "Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from March 28, 1979 Accident Three Mile Island Nuclear Station, Unit 2," (Disposal of Accident-Generated Water), June 1987 (ML20235A112).

35. NUREG-0683, Supplement 3, "Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from March 28, 1979 Accident Three Mile Island Nuclear Station, Unit 2," (Post-Defueling Monitored Storage and Subsequent Cleanup) dated August 1989 (ML20247F778).

36. NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Volumes 1 and 2, Regarding the Decommissioning of Nuclear Power Reactors," (GEIS)" dated November 2002.

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Attachments 2 through 7

Attachment 2
This attachment provides the POL and TS page markups described in the evaluation of proposed changes presented in Attachment 1.

Attachment 3
This attachment provides the POL and TS retyped pages that reflect the implementation of the proposed text changes described in Attachment 1 and Attachment 2.

Attachment 4
This attachment identifies the regulatory commitments associated with this amendment request. Other statements in this amendment request represent intended or planned actions, are provided for information purposes, and are not considered to be regulatory commitments.

Attachment 5
This attachment presents calculation TMI2-EN-RPT-0001 "Determination of the Safe Fuel Mass Limit for Decommissioning TMI-2." This calculation identifies a new safe fuel mass limit (SFML) for Three Mile Island Unit 2 decommissioning based on realistic but bounding assumptions about the material within the reactor vessel and outside the reactor vessel. This is accomplished through examination and application of material sampling results (i.e., impurities concentration), application of conservative assumptions where conditions are unknown or have associated uncertainty (i.e., fuel geometry, reflector), and taking credit for known phenomena (i.e., radioactive decay, burn-up). The sensitivity of each parameter to overall system reactivity is analyzed such that a balance between known and less certain parameters can be achieved.

Attachment 6
An affidavit is provided consistent with the requirements of 10 CFR 2.390 to withhold information from the public pertaining to the calculation presented in Attachment 6 TSD 21-003 "Decommissioning Radioactive Waste Handling Accident Calculation for TMI-2."

Attachment 7
This attachment presents calculation 21-003 Rev 00 "Decommissioning Radioactive Waste Handling Accident Calculation for TMI-2." This calculation develops an Alternate Source Term (AST) and accident evaluation for the active decommissioning of Three Mile Island Unit 2 (TMI-2). Potential accidents during active decommissioning are evaluated and it has been determined that an accident involving spent ion exchange resin has the highest potential off-site dose consequences. The probability of a spent ion exchange resin explosion or fire was determined from NUREG/CR-0130 "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station." This report uses TMI-2 resin waste streams decay corrected to January 1, 2021 to calculate the worst-case source terms that can be shipped for disposal in an 8-120 polyethylene High Integrity Container (HIC). The release activity from a 2-hour duration fire is calculated assuming 100 percent combustion of the contents and a conservative airborne release fraction. The report calculates ground release atmospheric dispersion coefficients (X/Q) using Regulatory Guide 1.145 "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants" methodology.

Attachment 2 to TMI2-RA-COR-2021-0002

License Amendment Request

Three Mile Island Nuclear Station, Unit 2

NRC Possession Only License No. DPR-73

Markup of Current POL and TS Pages, Including the Bases (Marked-Up Pages)

The current NRC approved TMI-2 Solutions POL and TS are marked up to show insertions and deletions of text based upon the results of the evaluation of proposed changes presented in Attachment 1.

TMI-2 SOLUTIONS, LLC

DOCKET NO. 50-320

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 2

POSSESSION ONLY LICENSE

Amendment No. ~~64~~**65**
License No. DPR-73

1. The U.S. Nuclear Regulatory Commission (the NRC or the Commission) has found that:

   A. The application for the transfer of the possession only license from Metropolitan Edison Company, Jersey Central Power and Light Company, Pennsylvania Electric Company, and GPU Nuclear, Inc. to TMI-2 Solutions, LLC (the Licensee) complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Chapter I, and all required notifications to other agencies or bodies have been duly made;

   B. The facility will be maintained in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission except for those exemptions from specific portions of the regulations, previously granted by the Commission, and still applicable;

   C. There is reasonable assurance: (i) that the activities authorized by this possession only license can be conducted without endangering the health and safety of the public; and (ii) that such activities will be conducted in compliance with the rules and regulations of the Commission;

   D. The licensee is technically qualified to engage in the activities authorized by this possession only license in accordance with the rules and regulations of the Commission;

   E. The licensee is financially qualified to engage in the activities authorized by this possession only license in accordance with the rules and regulations of the Commission;

   F. The licensee has satisfied the applicable provisions of 10 CFR Part 140, "Financial Protection Requirements and Indemnity Agreements," of the Commission's regulations;

   G. The issuance of this possession only license will not be inimical to the common defense and security or to the health and safety of the public;

   H. After weighing the environmental, economic, technical, and other benefits of the facility against environmental, and other costs and considering available alternatives, the issuance of Possession Only License No. DPR-73 subject to the conditions for protection of the environment set forth herein is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied; and

I. The possession of byproduct and special nuclear material and receipt, possession, and use of source material as authorized by the license will be in accordance with the Commission regulations in 10 CFR Parts 30, 40, and 70, including 10 CFR Sections 30.33, 40.32, 70.23, and 70.31.

2. Possession Only License No. DPR-73 is hereby issued to TMI-2 Solutions, LLC to read as follows:

A. This license applies to the Three Mile Island Nuclear Station, Unit 2, (the facility) owned by TMI-2 Solutions, LLC. The facility is located on Three Mile Island in the Susquehanna River in Londonderry Township, Dauphin County, Pennsylvania, about 10 miles southeast of Harrisburg. Prior to entry into Post-Defueling Monitored Storage (PDMS), the facility is described in the Final Safety Analysis Report as supplemented and amended, the various Recovery System Descriptions and Technical Evaluation Reports and the Environmental Report as supplemented and amended. Upon entry into PDMS, the facility is described in the PDMS Safety Analysis Report as supplemented and amended and the Environmental Report as supplemented and amended.

B. Subject to the conditions and requirements incorporated herein, the Commission hereby licenses:

(1) TMI-2 Solutions, LLC, pursuant to Section 103 of the Atomic Energy Act ("Act") and 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," to possess but not operate the facility;

(2) TMI-2 Solutions, LLC to possess the facility at the designated location in Dauphin County, Pennsylvania, in accordance with the procedures and limitations set forth in this license;

(3) TMI-2 Solutions, LLC, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use at any time any sealed sources for radiation monitoring equipment calibration;

(4) TMI-2 Solutions, LLC, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use in amounts as required any byproduct, source, or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(5) TMI-2 Solutions, LLC, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to possess, but not separate, such byproduct and special nuclear materials which remain at the facility subsequent to the cleanup following the March 28, 1979, accident.

The storage of radioactive materials or radwaste generated at TMI Unit 1 and stored at TMI Unit 2 in accordance with the license for TMI Unit 1 shall not result in a source term that, if released, would exceed that previously analyzed in the PDMS Safety Analysis Report in terms of off-site dose consequences.

C. This license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations in 10 CFR Chapter I, and is subject to all applicable provisions of the Act and to the Commission's rules and regulations, except for those exemptions from specific portions of the regulations granted by the Commission and still applicable, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Technical Specifications
The Technical Specifications, as revised through Amendment No. ~~64~~***65*** are hereby incorporated into this license. The licensee shall ~~operate~~ ***maintain*** the facility in accordance with the Technical Specifications and all Commission Orders issued subsequent to the date of the possession only license.

(2) Physical Protection
The licensee utilizes site physical security, guard training and qualification, and safeguards contingency plans maintained by Unit 1. These plans are administered under TMI-1 license condition 2.C.(3) and shall apply to TMI-2.

(3) Upon the date of closing, and proceeding until determination of completion of Phase 2 of facility decommissioning, TMI-2 Solutions will maintain a Financial Support Agreement in the amount of $100M, less the value of any cash-funded Provisional Trust Account, Disposal Capacity Easement, and Letter of Credit procured by TMI-2 Solutions for the benefit of the Back-Up Trust Account under the Back-Up & Provisional Trust Agreement.

(4) At time of closing, Energy*Solutions*, Inc. will provide a Parent Guarantee in favor of the FirstEnergy Companies to guarantee the payment and performance of the obligations of TMI-2 Solutions as to the TMI-2 decommissioning. This guarantee makes the resources of Energy*Solutions* available to help ensure the successful decommissioning of TMI-2, assuring the ability of TMI-2 Solutions to (i) pay the costs of decommissioning the TMI-2 facility; (ii) protect the public health and safety; and (iii) meet NRC requirements.

(5) These financial support conditions (2.C.(3) and 2.C.(4)) may not be voided, canceled, or modified without the prior written consent of the NRC. These financial support conditions are in place and will be maintained as described in the application. The Director of the Office of Nuclear Material Safety and Safeguards shall be informed, in writing, no later than 10 working days after any funds are provided under the terms of the conditions listed above.

D. ~~Special Auxiliary and Fuel Handling Building Ventilation Study: Prior to terminating continuous operation of the auxiliary and fuel handling buildings (AFHB) ventilation systems, the special monitoring program of AFHB airborne levels shall be completed. The program shall include at least 1 year of data prior to entry into PDMS and at least 1 year of data after entry into PDMS. A report shall be submitted to the NRC containing the results of the program containing sufficient data and analyses to demonstrate that the release rate of particulates with half-lives greater than 8 days from the AFHB will be less than 0.00024 μCi/sec when averaged over~~

~~any calendar quarter. Not included in the calculation of the particulate release rate shall be those periods of time (designated in advance) prior to entry into PDMS during which aggressive decontamination operations were performed in preparation for PDMS. The report shall be submitted to the NRC staff at least 60 days prior to terminating continuous operation of the AFHB ventilation systems.~~

~~E. Unfiltered Leak Rate Test: Prior to entry of the facility into Post-Defueling Monitored Storage, the licensee will develop an NRC-approved surveillance requirement for the reactor building unfiltered leak rate test that, upon staff approval, will be incorporated as Section 4.1.1.2 of the proposed PDMS Technical Specifications.~~

~~F. Additional Submittals Prior To Post-Defueling Monitored Storage: Prior to entry of the facility into Post-Defueling Monitored Storage, the licensee will submit and implement a site Flood Protection Plan, a site Radiation Protection Plan, an Offsite Dose Calculation Manual, a Post-Defueling Monitored Storage Fire Protection Program Evaluation, a Post-Defueling Monitored Storage Quality Assurance Plan and a Radiological Environmental Monitoring Plan. Additionally, the licensee will submit to the NRC the results of the completed plant radiation and contamination surveys prior to entry into PDMS.~~

G. This license is effective as of the date of issuance and until the Commission notifies the licensee in writing that the license is terminated.

FOR THE NUCLEAR REGULATORY COMMISSION

(Original signed by
Alfred E. Chaffee acting for)
Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Enclosure:
Appendi~~ces~~x A ~~& B~~
Technical Specifications

Date of Issuance: December 18, 2020

SECTION 1.0

DEFINITIONS

1.0 DEFINITIONS

DEFINED TERMS

1.1 The DEFINED TERMS of this section appear in capitalized type and are applicable throughout these Technical Specifications.

POST-DEFUELING MONITORED STORAGE

1.2 POST-DEFUELING MONITORED STORAGE (PDMS) is that condition where TMI-2 defueling has been completed, the core debris removed from the reactor during the cleanup period has been shipped off-site and the facility has been placed in a stable, safe, and secure condition.

~~ACTION~~

~~1.3 ACTION shall be those additional requirements specified as corollary statements to each specification and shall be part of the specifications.~~

~~OPERABLE - OPERABILITY~~

~~1.4 A system, subsystem, train, component or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s) and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).~~

~~CHANNEL CALIBRATION~~

~~1.5 An instrument CHANNEL CALIBRATION is a test, and adjustment, as necessary, to establish that the channel output responds with acceptable rang and accuracy to known values of the parameter which the channel measures or an accurate simulation of these values. CHANNEL CALIBRATION shall encompass the entire channel including equipment activation, alarm or trip, and shall be deemed to include the CHANNEL FUNCTIONAL TEST.~~

~~CHANNEL CHECK~~

~~1.6 A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.~~

~~CHANNEL FUNCTIONAL TEST~~

~~1.7 CHANNEL FUNCTIONAL TEST shall be the injection of a simulated signal into the channel as close to the primary sensor as practicable to verify OPERABILITY including alarm and/or trip functions.~~

~~1.0 DEFINITIONS~~

~~FREQUENCY NOTATION~~

~~1.8 The FREQUENCY NOTATION specified for the performance of surveillance requirements shall correspond to the intervals defined in Table 1.1.~~

~~CONTAINMENT ISOLATION~~

~~1.9 CONTAINMENT ISOLATION shall exist when:~~

~~a. Each penetration is:~~

~~1. Closed by a manual valve, a welded or bolted blind flange, a deactivated automatic valve secured in a closed position or other equivalent mechanical closure to provide isolation of each penetration, or~~

~~2. Open and the pathway to the environment provided with HEPA filter, or~~

~~3. Open in accordance with approved procedures. Controls shall be implemented to minimize the time the penetration is allowed open and to specify the conditions for which the penetration is open. Penetrations shall be expeditiously closed upon completion of the conditions specified in the approved procedures, and~~

~~b. The Equipment Hatch is closed, and~~

~~c. Each Containment Airlock is operable pursuant to Technical Specification 3.1.1.3.~~

~~BATCH RELEASE~~

~~1.10 A BATCH RELEASE is the discharge of a discrete volume.~~

~~CONTINUOUS RELEASE~~

~~1.11 A CONTINUOUS RELEASE is the discharge of a non-discrete volume, e.g., from a volume or system that has an input flow during the continuous release.~~

~~OFF-SITE DOSE CALCULATION MANUAL~~

~~1.12 OFF-SITE DOSE CALCULATION MANUAL (ODCM) shall contain the methodology and parameters used in the calculation of off-site doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, and in the conduct of the Radiological Environmental Monitoring Program. The ODCM shall also contain (1) the programs required by Section 6.7.4 and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operating and Annual Radioactive Effluent Release Reports required by Specifications 6.8.1.2 and 6.8.1.3.~~

~~1.0 DEFINITIONS~~

~~REPORTABLE EVENTS~~

~~1.13 A REPORTABLE EVENT shall be any of those conditions specified in Section 50.73 of 10 CFR Part 50.~~

~~STAGGERED TEST BASIS~~

~~1.14 A STAGGERED TEST BASIS shall consist of:~~

~~a. A test schedule for n systems, subsystems, trains or designated components obtained by dividing the specified test interval into n equal subintervals,~~

~~b. The testing of one system, subsystem, train or designated components at the beginning of each subinterval.~~

~~SUBSTANTIVE CHANGES~~

1.15 ~~SUBSTANTIVE CHANGES are those which affect the activities associated with a document or the document's meaning or intent. Examples of non-substantive changes are: (1) correcting spelling; (2) adding (but not deleting) sign-off spaces; (3) blocking in notes, cautions, etc.; (4) changes in corporate and personnel titles which do not reassign responsibilities and which are not referenced in the PDMS Technical Specifications; and (5) changes in nomenclature or editorial changes which clearly do not change function, meaning or intent.~~

~~1.0 DEFINITIONS~~

~~MEMBER(S) OF THE PUBLIC~~

~~1.16 MEMBER(s) OF THE PUBLIC means any individual except when that individual is receiving an occupational dose.~~

~~UNRESTRICTED AREA~~

~~1.17 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by TMI-2 Solutions, LLC for purposes of protection of Individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.~~

~~SITE BOUNDARY~~

~~1.18 The SITE BOUNDARY shall be that line beyond which the land is neither owned, nor leased, nor otherwise controlled by TMI-2 Solutions, LLC. The SITE BOUNDARY for gaseous and liquid effluents shall be as shown in the Offsite Dose Calculation Manual (ODCM).~~

~~NPDES PERMIT~~

~~1.19 The NPDES PERMIT is the National Pollutant Discharge Elimination System (NPDES) Permit No. PA0009920, effective January 30, 1975, Issued by the Environmental Protection Agency to Metropolitan Edison Company. This permit authorized Metropolitan Edison Company to discharge controlled wastewater from Three Mile Island (TMI) Nuclear Station Into the waters of the Commonwealth of Pennsylvania.~~

~~TABLE 1.1~~

~~FREQUENCY NOTATION~~

~~NOTATION~~	~~FREQUENCY~~
~~S~~	~~At least once per 12 hours.~~
~~D~~	~~At least once per 24 hours.~~
~~W~~	~~At least once per 7 days.~~
~~M~~	~~At least once per 31 days.~~
~~Q~~	~~At least once per 92 days.~~
~~SA~~	~~At least once per 184 days.~~
~~A~~	~~At least once per 12 months~~
~~R~~	~~At least once per 18 months~~
~~P~~	~~Completed prior to each release.~~
~~N/A~~	~~Not applicable.~~

~~SECTION 2.0~~

~~SAFETY LIMITS~~

~~2.0 SAFETY LIMITS~~

~~There are no safety limits which apply to TMI-2 during PDMS.~~

~~**SECTION 3/4**~~

~~**LIMITING CONDITIONS FOR PDMS**~~

~~**AND**~~

~~**SURVEILLANCE REQUIREMENTS**~~

~~3/4.0 LIMITING CONDITIONS FOR PDMS AND SURVEILLANCE REQUIREMENTS~~

~~3/4.0 APPLICABILITY~~

~~LIMITING CONDITIONS FOR PDMS~~

~~3.0.1 Limiting Conditions for PDMS and ACTION requirements shall be applicable during POST-DEFUELING MONITORED STORAGE or other conditions specified for each specification.~~

~~3.0.2 Adherence to the requirements of the Limiting Condition for PDMS and/or associated ACTION within the specified time interval shall constitute compliance with the specification. In the event the Limiting Condition for PDMS is restored prior to expiration of the specified time interval, completion of the ACTION statement is not required.~~

~~3.0.3 In the event a Limiting Condition for PDMS and/or associated ACTION requirements cannot be satisfied because of circumstances in excess of those addressed in the specification, initiate appropriate actions to rectify the problem to the extent possible under the circumstances and submit a report to the Commission pursuant to the requirements of 10 CFR50.73.~~

~~SURVEILLANCE REQUIREMENTS~~

~~4.0.1 Surveillance Requirements shall be met during PDMS or other conditions specified for individual Limiting Conditions for PDMS unless otherwise stated in an individual Surveillance Requirement.~~

~~4.0.2 Each Surveillance Requirement shall be performed within the specified time interval with a maximum allowable extension not to exceed 25% of the surveillance interval.~~

~~4.0.3 Failure to perform a Surveillance Requirement within the specified time interval shall constitute a failure to meet the OPERABILITY requirements for a Limiting Condition for PDMS. Exceptions to these requirements are stated in the individual Specifications. Surveillance Requirements do not have to be performed on inoperable equipment.~~

~~4.0.4 If it is discovered that a surveillance was not performed within its specified frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified frequency, whichever is less. This delay period is permitted to allow performance of the Surveillance.~~

~~3/4.1 CONTAINMENT SYSTEMS~~

~~3/4.1.1 PRIMARY CONTAINMENT~~

~~CONTAINMENT ISOLATION~~

~~LIMITING CONDITIONS FOR PDMS~~

~~3.1.1.1 Primary CONTAINMENT ISOLATION shall be maintained.~~

~~APPLICABILITY: PDMS~~

~~ACTION:~~

~~With CONTAINMENT ISOLATION not in accordance with requirements, restore CONTAINMENT ISOLATION within 24 hours.~~

~~SURVEILLANCE REQUIREMENTS~~

~~4.1.1.1 Primary CONTAINMENT ISOLATION shall be verified quarterly with the following exceptions:~~

~~a. Isolation valves that are locked closed shall be verified annually on a quarterly STAGGERED TEST BASIS. If a valve is found to be out of position, a check of all locked closed isolation valves shall be performed.~~

~~b. An independent verification of all isolation valve position changes shall be performed.~~

~~c. Bolted or welded blind flanges which form a containment isolation boundary and the Equipment Hatch shall be visually inspected for signs of degradation and/or leakage every five years on an annual STAGGERED TEST BASIS. If a problem is discovered with a flange, a check of all bolted or welded blind flanges shall be performed.~~

~~UNFILTERED LEAK RATE TESTING~~

~~LIMITING CONDITIONS FOR PDMS~~

~~3.1.1.2 The unfiltered leak rate from Containment with the RB Breather closed shall be less than 1/100 of the rate through the RB Breather.~~

~~APPLICABILITY: PDMS~~

~~ACTION:~~

~~If the unfiltered leak rate from Containment with the RB Breather closed is greater than 1/100 of the rate through the RB Breather or if the trend indicates that the 1/100 value will be exceeded within one year, then:~~

~~a. Identify the excessive leakage path;~~

~~b. Make necessary repairs and/or adjustments;~~

~~c. Perform an additional unfiltered leak rate test; and~~

~~d. Prepare and submit a special report to the Commission pursuant to Specification 6.8.2 within the next 30 days.~~

~~SURVEILLANCE REQUIREMENTS~~

~~4.1.1.2 The initial unfiltered leak rate test shall be performed two years following entry into PDMS. After the initial unfiltered leak rate test, the test frequency will be determined by comparing the ratios of the unfiltered leak rate to the RB Breather leak rate from previous and current tests. If the test results indicate that the ratio of unfiltered leakage to breather leakage is remaining constant or decreasing, then the next interval shall be five years.~~

~~SURVEILLANCE REQUIREMENTS~~

~~4.1.1.2 (con't)~~

~~If the test results indicate that the ratio of unfiltered leakage to breather leakage is increasing, i.e., the current ratio is greater than the previous ratio, then the next interval shall be determined by the following equation:~~

$$\cancel{N' = N \times \left[\frac{(0.01 - R_p)}{(R_c - R_p)} - 1 \right]}$$

~~*where:* N' = the next test interval,~~

~~N = the current test interval,~~

~~R_p = the previous ratio of unfiltered leakage to RB Breather leakage~~

~~R_c = the current ratio of unfiltered leakage to RB Breather leakage~~

~~The initial value of N shall equal two years. N' shall be the truncated integer result from the above equation, in years, but not more than five years nor less than one year.~~

~~Only ratios for successful tests shall be used to determine the next test interval in the above equation. Following a failed test the next test interval shall be one year.~~

~~CONTAINMENT AIR LOCKS~~

~~SURVEILLANCE REQUIREMENTS~~

~~3.1.1.3 Each Containment Air Lock shall be OPERABLE with at least one door closed except when the air lock is being used for transit entry and exit in accordance with site-approved procedures.~~

~~APPLICABILITY: PDMS~~

~~ACTION:~~

~~With no Containment Air Lock door OPERABLE, restore at least one door to OPERABLE status within 24 hours.~~

~~SURVEILLANCE REQUIREMENTS~~

~~4.1.1.3 Each Containment Air Lock shall be demonstrated OPERABLE every five (5) years by performing a mechanical operability check of each Air Lock Door, including a visual inspection of the components and lubrication if necessary and by visually inspecting the door seals for significant degradation. When both Containment Air Lock doors are opened simultaneously, verify the following conditions:~~

~~a. The capability exists to expeditiously close at least one Air Lock door;~~

~~b. The Air Lock doors and Containment Purge are configured to restrict the outflow of air in accordance with site-approved procedures; and~~

~~c. The Air Lock doors are cycled to ensure mechanical operability within seven days prior to opening both doors.~~

~~3/4.2 REACTOR VESSEL FUEL~~

~~3/4.2.1 REACTOR VESSEL FUEL REMOVAL/REARRANGEMENT~~

~~LIMITING CONDITIONS FOR PDMS~~

~~3.2.1.1 No more than 42 kg of fuel (i.e., UO_2) may be removed from the Reactor Vessel without prior NRC approval.~~

~~APPLICABILITY: PDMS~~

~~ACTION:~~

~~When more than 42 kg of fuel has been removed from the Reactor Vessel, suspend all further fuel removal activities and submit a safety analysis to the NRC for approval of this activity and any further fuel removal activities.~~

~~3.2.1.2 No more than 42 kg of fuel in the Reactor Vessel may be rearranged outside the geometry's analyzed in the Defueling Completion Report and the criticality safety analyses contained in GPU Nuclear letter C312-92-2080, dated December 18, 1992, without prior NRC approval.~~

~~APPLICABILITY: PDMS~~

~~ACTION:~~

~~When more than 42 kg of fuel in the Reactor Vessel has been rearranged, suspend all further fuel rearrangement activities and submit a safety analysis to the NRC for approval of this activity and any further fuel rearrangement activities. If an external event were to occur that could potentially cause more than 42 kg of fuel in the Reactor Vessel to be rearranged, a report will be submitted to the NRC detailing the findings of any investigation into that potential rearrangement.~~

~~SURVEILLANCE REQUIREMENTS~~

~~4.2.1.1 None required as long as no fuel is removed from the Reactor Vessel.~~

~~4.2.1.2 None required as long as no fuel in the Reactor Vessel is rearranged.~~

~~3/4.3 CRANE OPERATIONS~~

~~LIMITING CONDITIONS FOR PDMS~~

~~3.3.1 Loads in excess of 50,000 lbs. shall be prohibited from travel over the Reactor Vessel unless a docketed Safety Evaluation for the activity is approved by the NRC.~~

~~APPLICABILITY: PDMS~~

~~ACTION:~~

~~With the requirements of the above specification not satisfied, place the crane load in a safe condition and correct the circumstances which caused or allowed the Limiting Condition for PDMS to be exceeded prior to continuing crane operations limited by Specification 3.3.1. Prepare and submit a special report to the Commission pursuant to Specification 6.8.2 within the next 30 days.~~

~~3/4.4 SEALED SOURCES~~

~~3/4.4.1 SEALED SOURCE INTEGRITY~~

~~LIMITING CONDITIONS FOR PDMS~~

~~3.4.1 Each sealed source containing radioactive material either in excess of 2100 microcuries of beta and/or gamma emitting material or 5 microcuries of alpha emitting material (except as noted in 4.4.1.2) shall be free of ≥0.005 microcuries of removable contamination.~~

~~APPLICABLE: PDMS~~

~~ACTION:~~

~~a. Each sealed source with removable contamination in excess of the above limit shall be immediately withdrawn from use and:~~

~~1. Either decontaminate and repair, or~~

~~2. Dispose in accordance with Commission Regulations.~~

~~b. The provisions of Specification 3.0.3 are not applicable.~~

~~SURVEILLANCE REQUIREMENTS~~

~~TEST REQUIREMENTS~~

~~4.4.1.1 Each sealed source shall be tested for leakage and/or contamination by:~~

~~a. The licensee, or~~

~~b. Other persons specifically authorized by the Commission or an Agreement State.~~

~~The test method shall have a detection sensitivity of at least 0.005 microcuries per test sample.~~

~~TEST FREQUENCIES~~

~~4.4.1.2 Each category of sealed source shall be tested at the frequency described below.~~

~~a. Source in use (excluding fission detectors previously subjected to core flux) - At least once per six months for all sealed sources containing radioactive material:~~

~~1. With half life greater than 30 days (excluding Hydrogen 3) and~~

~~2. In any form other than gas.~~

~~<u>SURVEILLANCE REQUIREMENTS</u>~~

~~b. <u>Stored sources not in use</u> Each sealed source and fission detector shall be tested prior to use or transfer to another licensee unless tested within the previous six months. Sealed sources and fission detectors transferred without a certificate indicating the last test date shall be tested prior to being placed into use.~~

~~c. <u>Fission detectors</u> Each sealed fission detector shall be tested within 31 days prior to being subjected to core flux or installed in the core and following repair or maintenance to the source.~~

~~<u>REPORTS</u>~~

~~4.4.1.3 A report shall be prepared and submitted to the Commission on an annual basis if sealed source or fission detector leakage tests reveal the presence of ≥0.005 microcuries of removable contamination.~~

~~BASES~~

~~FOR~~

~~LIMITING CONDITIONS FOR PDMS~~

~~AND~~

~~SURVEILLANCE REQUIREMENTS~~

~~**NOTE**~~

~~**The summary statements contained in this section provide the bases for the Specifications of Section 3.0 and 4.0 and are not considered a part of these Technical Specifications as provided in 10 CFR 50.36.**~~

~~3/4.0 APPLICABILITY~~

~~BASES~~

~~The specifications of this section provide the general requirements applicable to each of the Limiting Conditions for PDMS and Surveillance Requirements within Section 3/4.~~

~~3.0.1 This specification defines the applicability of each specification in terms of PDMS or other specified conditions and is provided to delineate specifically when each specification is applicable.~~

~~3.0.2 This specification defines those conditions necessary to constitute compliance with the terms of an individual Limiting Condition for PDMS and associated ACTION requirement.~~

~~3.03 This specification defines the action and reporting requirements for those circumstances where the ACTION statement for Limiting Conditions for PDMS was exceeded.~~

~~4.0.1 This specification provides that the surveillance activities necessary to ensure the Limiting Conditions for PDMS are met and will be performed during the condition for which the Limiting Conditions for PDMS are applicable.~~

~~4.0.2 The provisions of this specification provide allowable tolerances for performing surveillance activities beyond those specified in the nominal surveillance interval. These tolerances are necessary to provide operational flexibility because of scheduling and performance considerations. The phrase "at least" associated with a surveillance frequency does not negate this allowable tolerance value and permits the performance of more frequent surveillance activities. It is not intended that this provision be used repeatedly as a convenience to extend surveillance intervals beyond that specified. The allowable tolerance is based on engineering judgement and the recognition that the most probable result of any particular surveillance being performed is the verification of conformance with the Surveillance Requirements. This provision is sufficient to ensure that the reliability ensured through surveillance activities is not significantly degraded beyond that obtained from the specified surveillance interval.~~

~~4.0.3 The provisions of this specification set forth the criteria for determination of compliance with the OPERABILITY requirements of the Limiting Conditions for PDMS. Under this criteria, equipment, systems or components are assumed to be OPERABLE if the associated surveillance activities have been satisfactorily performed within the specified time interval. Nothing in this provision is to be construed as defining equipment, systems or components as OPERABLE, when such items are found or known to be inoperable although still meeting the Surveillance Requirements~~

~~BASES~~

~~4.04 This specification establishes the flexibility to defer declaring affected equipment inoperable or an affected variable outside the specified limits when a surveillance has not been completed within the specified frequency. A delay period of up to 24 hours applies from the point in time that it is discovered that the required surveillance has not been performed and not at the time that the specified frequency was not met.~~

~~The delay period provides an adequate time to complete surveillances that have been missed. This delay period permits the completion of a surveillance before complying with required actions or other remedial measures that might preclude completion of the surveillance.~~

~~The basis for this delay period includes consideration of unit conditions, adequate planning, availability of personnel, the time required to perform the surveillance, the safety significance of the delay in completing the required surveillance, and the recognition that the most probable result of any particular surveillance being performed is the verification of conformance with the requirements.~~

~~When a surveillance with a frequency based not on time intervals, but upon specified unit conditions or operational situations, is discovered not to have been performed when specified, this provision allows the full delay period of 24 hours to perform the surveillance.~~

~~Failure to comply with specified surveillance frequencies is expected to be an infrequent occurrence. Use of the delay period is not intended to be used as an operational convenience to extend surveillance intervals.~~

~~If a surveillance is not completed within the allowed delay period, then the equipment is considered inoperable or the variable is considered outside the specified limits and the completion times of the required actions for the applicable LCO conditions begin immediately upon expiration of the delay period. If a surveillance is failed within the delay period, then the equipment is inoperable, or the variable is outside the specified limits and the completion times of the required actions for the applicable LCO conditions begin immediately upon failure of the surveillance.~~

~~Completion of the surveillance with the delay period allowed by this specification, or within the completion time of the actions, restores compliance.~~

~~3/4.1 CONTAINMENT SYSTEMS~~

~~BASES~~

~~3/4.1.1 PRIMARY CONTAINMENT~~

~~3/4.1.1.1 CONTAINMENT ISOLATION~~

~~CONTAINMENT ISOLATION is maintained to assure the Containment is properly maintained as a contamination barrier for the residual contamination which remains inside the Containment. One barrier either outside or inside of the Containment on each penetration is acceptable. See the PDMS SAR Section 7.2.1.1. Verification of CONTAINMENT ISOLATION is primarily accomplished by visual inspection; however, in cases where this is not practical due to the valve or valves being located in a locked high radiation area, documented evidence of the valves closure may be used. Penetrations which have been isolated by chain locked valves provide a high degree of assurance that CONTAINMENT ISOLATION is being maintained and, therefore, require only annual surveillance on a STAGGERED TEST BASIS. Penetrations which have been closed by bolted or welded blind flanges provide an even higher degree of assurance that CONTAINMENT ISOLATION is being maintained and, therefore, require surveillance only every five years also on a STAGGERED TEST BASIS. However, if a valve is found out of position or a problem with a flange is discovered, a complete verification check would be performed to provide assurance that CONTAINMENT ISOLATION is being maintained.~~

~~3/4.1.1.2 UNFILTERED LEAK RATE TESTING~~

~~The Reactor Building fire analysis presented in SAR Section 8.2.5 Case 3 assumes that the mass flowrate of unfiltered leakage is less than 1/100 of the mass flowrate released through the 99% efficient RB Breather HEPA filter. SAR Section 7.2.1.2.3 provides the details of the calculation using an unfiltered leak rate test to demonstrate compliance with this Limiting Condition for PDMS. The test interval is variable due to the uncertainty inherent in maintaining the unfiltered leakage to a small fraction of the leakage through the RB Breather.~~

~~3/4.1.1.3 CONTAINMENT AIR LOCKS~~

~~The Containment Air Locks must be maintained OPERABLE to provide CONTAINMENT ISOLATION. These air locks will be used during entries into the Containment to ensure that radioactive materials are not unnecessarily being released to the environs. The preferred method for ensuring that radioactive materials are not released during these entries is to maintain at least one door closed at all times; however, if circumstances require, both doors may be open simultaneously in accordance with site-approved procedures.~~

~~3/4.2 REACTOR VESSEL FUEL~~

~~BASES~~

~~3/4.2.1 REACTOR VESSEL FUEL REMOVAL/REARRANGEMENT~~

~~NRC Inspection Report 50-320/90-30, dated June 14, 1990, imposed restrictions on the removal and/or rearrangement of the residual fuel in the Reactor Vessel. In particular, the NRC stated in Section 3.0, "Safe Fuel Mass Limit," of that inspection report that the appropriate safe fuel mass limit in the Reactor Vessel (RV) was determined to be 93 kg of core debris. Based on industry practice, a limit of approximately 45% of the SFML was placed on the amount of core debris that may be removed from the RV or rearranged in the RV. This limit is specified to ensure subcriticality even after dual errors. Thus, if the fuel in the RV is rearranged outside the analyzed geometries used in the Defueling Completion Report or the criticality safety analyses contained in GPU Nuclear letter C312-92-2080, dated December 18, 1992, the 42 kg limit will apply to the rearranged fuel. Further, if any fuel is removed from the RV in the future, the 42 kg limit will also apply to that fuel.~~

~~3/4.3 CRANE OPERATIONS~~

~~BASES~~

~~A load drop into the RV may cause reconfiguration of the core debris outside the analyzed geometries used in the Defueling Completion Report RV criticality analysis.~~

~~3/4.4 SEALED SOURCES~~

~~BASES~~

~~3/4.4.1 SEALED SOURCE INTEGRITY~~

~~The limitation on removable contamination for sources requiring leak testing, including alpha emitters, is based on 10 CFR 70.39(c) limits for plutonium. This limitation will ensure that leakage from byproduct, source, and Special Nuclear Material sources will not exceed allowable intake values.~~

~~SECTION 5.0~~

~~DESIGN FEATURES~~

~~5.0 DESIGN FEATURES~~

~~5.1 CONTAINMENT~~

~~CONFIGURATION~~

~~5.1.1 The Containment Building is a steel lined, reinforced concrete building of cylindrical shape, with a dome roof and having the following design features:~~

~~a. Nominal inside diameter = 130 feet.~~

~~b. Nominal inside height = 157 feet.~~

~~c. Minimum thickness of concrete walls = 4 feet.~~

~~d. Minimum thickness of concrete roof = 3.5 feet.~~

~~e. Minimum thickness of concrete floor pad = 13.5 feet.~~

~~f. Nominal thickness of steel liner = 1/2 inches.~~

~~g. Net free volume = 2.1 x 10^6 cubic feet.~~

~~h. Design Pressure = 5.0 psig.~~

SECTION 6.0

ADMINISTRATIVE CONTROLS

6.0 ADMINISTRATIVE CONTROLS

~~6.1 Responsibility~~

~~6.1.1 The TMI-2 Solutions, LLC Project Director is responsible for the management of overall unit operations at Unit 2 and shall delegate in writing the succession to this responsibility during absence.~~

~~6.2 ORGANIZATION~~

~~TMI-2 SOLUTIONS ORGANIZATION~~

~~6.2.1 The TMI-2 Solutions, LLC organization for unit management and technical support shall be as in Section 10.5 of the PDMS SAR.~~

~~TMI-2 SOLUTIONS UNIT ORGANIZATION~~

~~6.2.2 The unit organization shall be as described in Section 10.5 of the PDMS SAR and an individual qualified in radiation protection procedures shall be on site whenever Radioactive Waste Management activities are in progress.~~

~~6.3 UNIT STAFF QUALIFICATIONS~~

~~6.3.1 Each member of the unit staff shall meet or exceed the minimum qualifications of ANSI N18.1-1971 for comparable positions unless otherwise noted in the Technical Specifications. The requirements of ANSI N18.1-1971that pertain to operator license qualifications for unit staff shall not apply.~~

~~6.3.2 The management position responsible for radiological control or his deputy shall meet or exceed the qualifications of Regulatory Guide 1.8 of 1977. Each Radiological Controls Technician in a responsible position shall meet or exceed the qualifications of ANSI N18.1-1971, paragraph 4.5.2 or 4.3.2, or be formally qualified through an NRC-approved TMI Radiation Controls training program. All Radiological Controls Technicians will be qualified through training and examination in each area or specific task related to their radiological controls functions prior to their performance of those tasks.~~

~~6.4 DELETED~~

~~ADMINISTRATIVE CONTROLS~~

~~6.5 **DELETED**~~

~~6.5.1 **DELTED**~~

~~**DELETED**~~

~~ADMINISTRATIVE CONTROLS~~

~~**DELETED**~~

~~**DELETED**~~

~~6.5.2 **DELETED**~~

~~**DELETED**~~

~~**DELETED**~~

~~**DELETED**~~

~~**DELETED**~~

~~6.5.3 **DELETED**~~

~~DELETED~~

~~6.5.4~~ **~~DELETED~~**

~~6.6 REPORTABLE EVENT ACTION~~

~~6.6.1 The following actions shall be taken for REPORTABLE EVENTS:~~

~~a. The Nuclear Regulatory Commission shall be notified and/or a report submitted pursuant to the requirements of Section 50.73 to 10 CFR 50.~~

~~6.7 PROCEDURES AND PROGRAMS~~

~~6.7.1 Written procedures shall be established, implemented, and maintained for the activities necessary to maintain the PDMS condition as described in the PDMS SAR. Examples of these activities are:~~

~~a. Technical Specification implementation.~~

~~b. Radioactive waste management and shipment.~~

~~c. Radiation Protection Plan Implementation.~~

~~d. Fire Protection Program implementation.~~

~~e. Flood Protection Program implementation.~~

~~6.7 PROCEDURES AND PROGRAMS (cont'd)~~

~~6.7.2 Each procedure required by Section 6.7.1, and SUBSTANTIVE CHANGES thereto, shall be reviewed and approved prior to implementation and shall be reviewed periodically as follows:~~

~~a. At least every two years, the group responsible for Quality Assurance will assess a representative sample of plant procedures that are used more frequently than every two years.~~

~~b. Plant procedures that have been used at least biennially receive scrutiny by individuals knowledgeable in procedures, and are updated as necessary to ensure adequacy during suitable controlled activities.~~

~~c. Plant procedures that have not been used for two years will be reviewed before use or biennially to determine if changes are necessary or desirable.~~

~~6.7.3 Temporary changes to procedures in Section 6.7.1 above may be made provided:~~

~~a. The intent of the original procedures is not altered;~~

~~b. The change is approved by two members of the responsible organization knowledgeable in the area affected by the procedure. For changes which may affect the operational status of unit systems or equipment, at least one of these individuals shall be a member of unit management or supervision; and~~

~~c. The change is documented, reviewed and approved within 14 days of implementation.~~

~~6.7.4 The following programs shall be established, implemented, and maintained:~~

~~a. Radioactive Effluent Controls Program~~

~~A program shall be provided conforming with 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to MEMBERS OF THE PUBLIC from radioactive effluents as low as reasonably achievable. The program shall be contained in the ODCM, (2) shall be implemented by operating procedures, and (3) shall include remedial actions to be taken whenever the program limits are exceeded. The program shall include the following elements:~~

~~6.7 PROCEDURES AND PROGRAMS (cont'd)~~

1. ~~Limitations on the operability of radioactive liquid and gaseous monitoring instrumentation including surveillance tests and setpoint determination in accordance with the methodology in the ODCM,~~

2. ~~Limitations on the concentrations of radioactive material released in liquid effluents to UNRESTRICTED AREAS conforming to 10 times the concentrations specified in 10 CFR Part 20.1001 – 20.2402, Appendix B, Table 2, Column 2,~~

3. ~~Monitoring, sampling, and analysis of radioactive liquid and gaseous effluents in accordance with 10 CFR 20.1302 and with the methodology and parameters in the ODCM,~~

~~4. Limitations on the annual and quarterly doses or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from the unit to the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,~~

~~5. Determination of cumulative and projected dose contributions from radioactive effluents for the current calendar quarter and current calendar year in accordance with the methodology and parameters in the ODCM at least every 31 days,~~

~~6. Limitations on the operability and use of the liquid and gaseous effluent treatment systems to ensure that the appropriate portions of these systems are used to reduce releases of radioactivity when the projected doses in a 31-day period would exceed 2 percent of the guidelines for the annual dose or dose commitment conforming to Appendix I to 10 CFR Part 50,~~

~~7. Limitations on the dose rate resulting from radioactive material released in gaseous effluents to areas at or beyond the SITE BOUNDARY. The limits are as follows:~~

~~a) For noble gases: less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin, and~~

~~b) For tritium and all radionuclides in particulate form with half lives greater than 8 days: less than or equal to 1500 mrem/yr to any organ,~~

~~8. Limitations on the annual and quarterly air doses resulting from noble gases released in gaseous effluents from the unit to areas beyond the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,~~

~~9. Limitations on the annual and quarterly doses to a MEMBER OF THE PUBLIC from tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from each unit to areas beyond the SITE BOUNDARY conforming to Appendix I to 10 CFR Part 50,~~

~~10. Limitations on the annual dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources conforming to 40 CFR Part 190.~~

~~b. Radiological Environmental Monitoring Program~~

~~A program will be provided to monitor the radiation and radionuclides in the environs of the plant. The program shall provide (1) representative measurements of radioactivity in the highest potential exposure pathways, and (2) verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall (1) be contained in the ODCM, (2) conform to the guidance of Appendix I to 10 CFR Part 50, and (3) include the following:~~

~~6.7 PROCEDURES AND PROGRAMS (con't)~~

~~1. Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in the ODCM.~~

~~2. A Land Use Census to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the monitoring program are made if required by the results of the census, and~~

~~3. Participation in an Interlaboratory Comparison Program to ensure that the independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.~~

~~6.8 REPORTING REQUIREMENTS~~

~~ROUTINE REPORTS~~

~~6.8.1 In addition to the applicable reporting requirements of Title 10, Code of Federal Regulations, the following reports shall be in accordance with 10 CFR 50.4 unless otherwise noted. Some of the reporting requirements of Title 10, Code of Federal Regulations are repeated below.~~

~~ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT~~

~~6.8.1.1 The Annual Radiological Environmental Operating Report covering the operation of the unit during the previous calendar year shall be submitted before May 1 of each year. The report shall include summaries, interpretations, and analysis of trends of the results of the Radiological Environmental Monitoring Program for the reporting period. The material provided shall be consistent with the objectives outlined in (1) the ODCM and (2) Sections IV.B.2, IV.B.3, and IV.C of Appendix I to 10 CFR Part 50.~~

~~ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT~~

~~6.8.1.2 The Annual Radiological Effluent Release Report covering the operation of the unit during the previous calendar year shall be submitted before May 1 each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be (1) consistent with the objectives outlined in the ODCM and (2) in conformance with 10 CFR 50.36a and Section IV.B.1 of Appendix I to 10 CFR Part 50.~~

~~6.8 REPORTING REQUIREMENTS (cont'd)~~

~~BIENNIAL REPORTS~~

~~6.8.1.4 Reports required on a biennial basis shall be submitted on a frequency not to exceed once every two years (24 months). The reports shall cover the activities of the unit as described below up to a minimum of 6 months prior to the date of the filing.~~

~~Reports required on a biennial basis shall include:~~

~~a. All changes made to the PDMS SAR during the previous update.~~

~~b. All changes, tests, or experiments meeting the requirements of 10 CFR 50.59.~~

~~SPECIAL REPORTS~~

~~6.8.2 Special reports shall be submitted in accordance with 10 CFR 50.4 within the time period specified for each report.~~

~~NONROUTINE REPORTS~~

~~6.8.3 A report shall be submitted in the event that an Exceptional Occurrence as specified in Section 6.13 occurs. The report shall be submitted under one of the report schedules described below.~~

~~6.8 REPORTING REQUIREMENTS (con't)~~

~~PROMPT REPORTS~~

~~6.8.3.1 Those events specified as prompt report occurrences shall be reported within 24 hours by telephone, telegraph, or facsimile transmission to the NRC followed by a written report to the NRC within 30 days.~~

~~THIRTY DAY EVENT REPORTS~~

~~6.8.3.2 Nonroutine events not requiring a prompt report as described in Subsection 6.8.3.1, shall be reported to the NRC either within 30 days of their occurrence or within the time limit specified by the reporting requirement of the corresponding certification or permit issued pursuant to Sections 401 or 402 of PL 92-500, the Federal Water Pollution Control Act (FWPCA) Amendment of 1972, whichever time duration following the nonroutine event shall result in the earlier submittal.~~

~~CONTENT OF NONROUTINE REPORTS~~

~~6.8.3.3 Written 30-day reports and, to the extent possible, the preliminary telephone, telegraph, or facsimile reports shall (a) describe, analyze, and evaluate the occurrence, including extent and magnitude of the impact, (b) describe the cause of the occurrence, and (c) indicate the corrective action (including any significant changes made in procedures) taken to preclude repetition of the occurrence and to prevent similar occurrences involving similar components or systems.~~

~~6.9 RECORD RETENTION~~

~~6.9.1 The following records shall be retained for at least five years:~~

~~a. Records of sealed source and fission detection leak tests and results.~~

~~b. Records of annual physical inventory of all sealed source material of record.~~

~~6.9.2 The following records shall be retained as long as the Licensee has an NRC license to operate or possess the Three Mile Island facility.~~

~~a. Records and logs of unit operation covering time interval at each power level.~~

~~b. Records and logs of principal maintenance activities, inspections, repair and replacement of principal items of equipment related to nuclear safety and radioactive waste systems.~~

~~c. ALL REPORTABLE EVENTS submitted to the Commission.~~

~~d. Records of surveillance activities, inspections and calibrations required by these Technical Specifications.~~

~~6.9 RECORDS RETENTION (Con't)~~

~~e. Records of changes made to the procedures required by Recovery Technical Specification 6.8.1 and PDMS Technical Specification 6.7.1.~~

~~f. Radiation Safety Program Reports and Quarterly Recovery Progress Reports on the March 28, 1979 incident.~~

~~g. Records of radioactive shipments.~~

~~h. Records and logs of radioactive waste systems operations.~~

~~i. Records and drawing changes reflecting facility design modifications made to systems and equipment described in the Safety Analysis Report, TER, SD, or Safety Evaluation previously submitted to NRC.~~

~~j. Records of new and irradiated fuel inventory, fuel transfers and assembly burnup histories.~~

~~k. Records of transient or operational cycles for those unit components designed for a limited number of transients or cycles.~~

~~l. Records of reactor tests and experiments.~~

~~m. Records of training and qualification for current members of the unit staff.~~

~~n. Records of in-service inspections previously required by the Technical Specifications.~~

~~o. Records of Quality Assurance activities required by the Operating, Recovery, or PDMS Quality Assurance Plans.~~

~~p. Records of reviews performed for changes made to procedures or equipment or reviews of tests and experiments pursuant to 10 CFR 50.59.~~

~~q. Records of meetings of the Plant Operation Review Committee (PORC) and the Generation Review Committee (GRC), and reports of evaluations prepared by the IOSRG, if applicable to TMI-2.~~

~~r. Records of the incident which occurred on March 28, 1979.~~

~~s. Records of unit radiation and contamination surveys.~~

~~t. Records of radiation exposure received by all individuals for whom monitoring was required.~~

~~6.9 RECORD RETENTION (Cont'd)~~

~~u. Records of gaseous and liquid radioactive material released to the environs.~~

~~v. Records of reviews performed for changes made to the OFFSITE DOSE CALCULATION MANUAL~~

6.10 ~~RADIATION PROTECTION PROGRAM~~

~~Procedures for personnel radiation protection shall be prepared consistent with the requirements of 10 CFR Part 20 and shall be approved, maintained, and adhered to for all operations involving personnel radiation exposure.~~

6.11 HIGH RADIATION AREA

Pursuant to 10 CFR Part 20, paragraph 20.1601 (c), in lieu of the requirements of paragraph 20.1601(a) and 20.1601(b) of 10 CFR Part 20:

6.11.1 Access to each high radiation area, as defined in 10 CFR 20, in which an individual could receive a deep dose equivalent > 0.1 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation) shall be controlled as described below to prevent unauthorized entry.

a. Each area shall be barricaded and conspicuously posted as a high radiation area. Such barricades may be opened as necessary to permit entry or exit of personnel or equipment.

b. Entrance shall be controlled by requiring issuance of a Radiation Work Permit (RWP) or equivalent that includes specification of radiation dose rate in the immediate work area(s) and other appropriate radiation protection equipment and measures.

c. Individuals qualified in radiation protection procedures or personnel continuously escorted by such individuals may, for the performance of their assigned duties in high radiation areas, be exempt from the preceding requirements for issuance of an RWP or equivalent provided they are otherwise following plant radiation protection procedures for entry into, exit from, and work in such high radiation areas.

d. Each individual or group of individuals permitted to enter such areas shall possess, or be accompanied by, one or more of the following:

1. A radiation monitoring device that continuously indicates the radiation dose rate in the area.

2. A radiation monitoring device that continuously integrates the radiation dose rate in the area and alarms when a preset setpoint is reached. Entry into high radiation areas with this monitoring device may be made after the dose rate in the area has been determined and personnel have been made knowledgeable of it.

3. A radiation monitoring device that continuously transmits dose rate and cumulative dose information to a remote receiver monitored by radiation protection personnel responsible for controlling personnel radiation exposure within the area.

4. An individual qualified in radiation protection procedures equipped with a radiation dose rate monitoring device. This individual shall be responsible for providing positive radiation protection control over the activities within the area and shall perform periodic radiation surveillance at the frequency specified by radiation protection supervision.

6.11.2 In addition to the requirements of Specification 6.12.1, high radiation areas in which an individual could receive a deep dose equivalent > 1.0 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation), but less than 500 rads/hour (at 1 meter from the radiation source or from any surface penetrated by the radiation) shall be provided with a locked or continuously guarded door, or gate, or equivalent to prevent unauthorized entry.

a. The keys to such locked doors or gates, or equivalent, shall be administratively controlled in accordance with a program approved by the radiation protection manager.

b. Doors and gates, or equivalent, shall remain locked except during periods of access by personnel under an approved RWP, or equivalent, to ensure individuals are informed of the dose rate in the immediate work areas prior to entry.

c. Individual high radiation areas in which an individual could receive a deep dose equivalent> 1.0 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation), accessible to personnel, that are located within larger areas where no enclosure exists to enable locking, or that are not continuously guarded, and where no lockable enclosure can be reasonably constructed around the individual area require both of the following access controls:

1. Each area shall be barricaded and conspicuously posted.

2. A flashing light shall be activated as a warning device.

~~6.11.1 In lieu of the "control device" or "alarm signal" required by paragraph 20.1601 of 10 CFR 20:~~

~~a. Each High Radiation Area in which the intensity of radiation at 30 cm (11.8 in.) is greater than 100 mrem/hr deep dose but less than 1000 mrem/hr shall be barricaded and conspicuously posted as a High Radiation Area, and personnel desiring entrance shall obtain a Radiation Work Permit (RWP). Any individual or group of individuals entering a High Radiation Area shall (a) use a continuously indicating dose rate monitoring device or (b) use a radiation dose rate integrating device which alarms at a pre-set dose level (entry into such areas with this monitoring device may be made after the dose rate level in the area has been established and personnel have been made knowledgeable of them), or (c) assure that a radiological control technician provides positive control over activities within the area and periodic radiation surveillance with a dose rate monitoring instrument.~~

~~b. In addition to the requirements of specification 6.11.1.a:~~

~~1. Any area accessible to personnel where an individual could receive in any one hour a deep dose in excess of 1000 mrem at 30 cm (11.8 in.) but less than 500 rads at one meter (3.28 ft), from sources of radioactivity shall be locked or guarded to prevent unauthorized entry. The keys to these locked barricades shall be maintained under the administrative control of the respective Radiological Controls Supervisor.~~

~~2. For individual high radiation areas where an individual could receive in any one hour a deep dose in excess of 1000 mrem at 20 cm (11.8 in.) but less than 500 rads at one meter (3.28 ft.), that are located within large areas such as reactor containment, where no enclosure exists for purposes of locking, and where no enclosure can be reasonably constructed around the individual area, that individual area shall be barricaded and conspicuously posted, and a flashing light shall be activated as a warning device.~~

~~The Radiation Work Permit is not required by Radiological Controls personnel during the performance of their assigned radiation protection duties provided they are following radiological control procedures for entry into High Radiation Areas.~~

~~6.12 OFFSITE DOSE CALCULATION MANUAL (ODCM)~~

~~SUBSTANTIVE CHANGES to the ODCM:~~

~~a. Shall be documented and records of reviews performed shall be realized as required by Specification 6.9.2v. This documentation shall contain:~~

~~1. Sufficient information to support the change together with the appropriate analyses or evaluations justifying the change(s); and~~

~~2. A determination that the change will maintain the level of radioactive effluent control required by 10 CFR 20.1301, 40 CFR Part 190, 10 CFR 50.36a and Appendix I to 10 CFR Part 50 and not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations.~~

~~b. Shall become effective after review and acceptance by TMI-2 Solutions, LLC Project Director.~~

~~c. Shall be submitted to the Commission in the form of a complete, legible copy of the entire ODCM as part of or concurrent with the Annual Radioactive Effluent Release Report for the period of the report in which any change to the ODCM was made. Each change shall be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (e.g., month/year) the change was implemented.~~

~~6.13 EXCEPTIONAL OCCURRENCES~~

~~UNUSUAL OR IMPORTANT ENVIRONMENTAL EVENTS~~

~~6.13.1 Any occurrence of an unusual or important event that causes or could potentially cause significant environmental impact causally related with station operation shall be recorded and reported to the NRC per Subsection 6.8.3.1. The following are examples of such events: excessive bird impaction events on cooling tower structures or meteorological towers (i.e., more than 100 in any one day); onsite plant or animal disease outbreaks; unusual mortality of any species protected by the Endangered Species Act of 1973; fish kills near or downstream of the site.~~

~~EXCEEDING LIMITS OF RELEVANT PERMITS~~

~~6.13.2 Any occurrence of exceeding the limits specified in relevant permits and certificates issued by other Federal and State agencies which are reportable to the agency which issued the permit shall be reported to the NRC in accordance with the provisions of Subsection 6.8.3.2. This requirement shall apply only to topics of National Environmental Policy Act concern within the requirements of the Station NPDES permit as related to TMI-2 discharges.~~

~~6.14 DELETED~~

~~6.14 (cont'd) DELETED~~

Attachment 3 to TMI2-RA-COR-2021-0002

License Amendment Request

Three Mile Island Nuclear Station, Unit 2

NRC Possession Only License No. DPR-73

Proposed Technical Specifications (Retyped Pages)

The current NRC approved TMI-2 Solutions POL and TS are retyped to reflect the addition or deletion of text as identified in the evaluation of proposed changes presented in Attachment 1 and markups presented in Attachment 2.

The proposed changes to the TS are considered a major rewrite. Revised formatting (margins, font, tabs, etc.) of content is used to create a continuous electronic file. Revised numbering of pages and sections and the deletion of unused placeholders, where appropriate, is used to condense and reduce the number of pages in the TS without affecting the technical content. Since the changes to the TS are considered a major rewrite, revision bars are not used.

TMI-2 SOLUTIONS, LLC

DOCKET NO. 50-320

THREE MILE ISLAND NUCLEAR STATION, UNIT NO. 2

POSSESSION ONLY LICENSE

Amendment No. 65
License No. DPR-73

1. The U.S. Nuclear Regulatory Commission (the NRC or the Commission) has found that:

   A. The application for the transfer of the possession only license from Metropolitan Edison Company, Jersey Central Power and Light Company, Pennsylvania Electric Company, and GPU Nuclear, Inc. to TMI-2 Solutions, LLC (the Licensee) complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Chapter I, and all required notifications to other agencies or bodies have been duly made;

   B. The facility will be maintained in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission except for those exemptions from specific portions of the regulations, previously granted by the Commission, and still applicable;

   C. There is reasonable assurance: (i) that the activities authorized by this possession only license can be conducted without endangering the health and safety of the public; and (ii) that such activities will be conducted in compliance with the rules and regulations of the Commission;

   D. The licensee is technically qualified to engage in the activities authorized by this possession only license in accordance with the rules and regulations of the Commission;

   E. The licensee is financially qualified to engage in the activities authorized by this possession only license in accordance with the rules and regulations of the Commission;

   F. The licensee has satisfied the applicable provisions of 10 CFR Part 140, "Financial Protection Requirements and Indemnity Agreements," of the Commission's regulations;

   G. The issuance of this possession only license will not be inimical to the common defense and security or to the health and safety of the public;

   H. After weighing the environmental, economic, technical, and other benefits of the facility against environmental, and other costs and considering available alternatives, the issuance of Possession Only License No. DPR-73 subject to the conditions for protection of the environment set forth herein is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied; and

I. The possession of byproduct and special nuclear material and receipt, possession, and use of source material as authorized by the license will be in accordance with the Commission regulations in 10 CFR Parts 30, 40, and 70, including 10 CFR Sections 30.33, 40.32, 70.23, and 70.31.

2. Possession Only License No. DPR-73 is hereby issued to TMI-2 Solutions, LLC to read as follows:

A. This license applies to the Three Mile Island Nuclear Station, Unit 2, (the facility) owned by TMI-2 Solutions, LLC. The facility is located on Three Mile Island in the Susquehanna River in Londonderry Township, Dauphin County, Pennsylvania, about 10 miles southeast of Harrisburg. Prior to entry into Post-Defueling Monitored Storage (PDMS), the facility is described in the Final Safety Analysis Report as supplemented and amended, the various Recovery System Descriptions and Technical Evaluation Reports and the Environmental Report as supplemented and amended. Upon entry into PDMS, the facility is described in the PDMS Safety Analysis Report as supplemented and amended and the Environmental Report as supplemented and amended.

B. Subject to the conditions and requirements incorporated herein, the Commission hereby licenses:

(1) TMI-2 Solutions, LLC, pursuant to Section 103 of the Atomic Energy Act ("Act") and 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," to possess but not operate the facility;

(2) TMI-2 Solutions, LLC to possess the facility at the designated location in Dauphin County, Pennsylvania, in accordance with the procedures and limitations set forth in this license;

(3) TMI-2 Solutions, LLC, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use at any time any sealed sources for radiation monitoring equipment calibration;

(4) TMI-2 Solutions, LLC, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use in amounts as required any byproduct, source, or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(5) TMI-2 Solutions, LLC, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to possess, but not separate, such byproduct and special nuclear materials which remain at the facility subsequent to the cleanup following the March 28, 1979, accident.

The storage of radioactive materials or radwaste generated at TMI Unit 1 and stored at TMI Unit 2 in accordance with the license for TMI Unit 1 shall not result in a source term that, if released, would exceed that previously analyzed in the PDMS Safety Analysis Report in terms of off-site dose consequences.

C. This license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations in 10 CFR Chapter I, and is subject to all applicable provisions of the Act and to the Commission's rules and regulations, except for those exemptions from specific portions of the regulations granted by the Commission and still applicable, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Technical Specifications
The Technical Specifications, as revised through Amendment No. 65 are hereby incorporated into this license. The licensee shall maintain the facility in accordance with the Technical Specifications and all Commission Orders issued subsequent to the date of the possession only license.

(2) Physical Protection
The licensee utilizes site physical security, guard training and qualification, and safeguards contingency plans maintained by Unit 1. These plans are administered under TMI-1 license condition 2.C.(3) and shall apply to TMI-2.

(3) Upon the date of closing, and proceeding until determination of completion of Phase 2 of facility decommissioning, TMI-2 Solutions will maintain a Financial Support Agreement in the amount of $100M, less the value of any cash-funded Provisional Trust Account, Disposal Capacity Easement, and Letter of Credit procured by TMI-2 Solutions for the benefit of the Back-Up Trust Account under the Back-Up & Provisional Trust Agreement.

(4) At time of closing, Energy*Solutions*, Inc. will provide a Parent Guarantee in favor of the FirstEnergy Companies to guarantee the payment and performance of the obligations of TMI-2 Solutions as to the TMI-2 decommissioning. This guarantee makes the resources of Energy*Solutions* available to help ensure the successful decommissioning of TMI-2, assuring the ability of TMI-2 Solutions to (i) pay the costs of decommissioning the TMI-2 facility; (ii) protect the public health and safety; and (iii) meet NRC requirements.

(5) These financial support conditions (2.C.(3) and 2.C.(4)) may not be voided, canceled, or modified without the prior written consent of the NRC. These financial support conditions are in place and will be maintained as described in the application. The Director of the Office of Nuclear Material Safety and Safeguards shall be informed, in writing, no later than 10 working days after any funds are provided under the terms of the conditions listed above.

D. DELETED

E. DELETED

F. DELETED

G. This license is effective as of the date of issuance and until the Commission notifies the licensee in writing that the license is terminated.

FOR THE NUCLEAR REGULATORY COMMISSION

(Original signed by
Alfred E. Chaffee acting for)
Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Enclosure:
Appendix A
Technical Specifications

Date of Issuance:

SECTION 1.0

DEFINITIONS

1.0 DEFINITIONS

DEFINED TERMS

1.1 The DEFINED TERMS of this section appear in capitalized type and are applicable throughout these Technical Specifications.

POST-DEFUELING MONITORED STORAGE

1.2 POST-DEFUELING MONITORED STORAGE (PDMS) is that condition where TMI-2 defueling has been completed, the core debris removed from the reactor during the cleanup period has been shipped off-site and the facility has been placed in a stable, safe, and secure condition.

Section 2-Not Used

Section 3-Not Used

Section 4-Not Used

Section 5-Not Used

SECTION 6.0

ADMINISTRATIVE CONTROLS

6.0 ADMINISTRATIVE CONTROLS

6.11 HIGH RADIATION AREA

Pursuant to 10 CFR Part 20, paragraph 20.1601(c), in lieu of the requirements of paragraph 20.1601(a) and 20.1601(b) of 10 CFR Part 20:

6.11.1 Access to each high radiation area, as defined in 10 CFR 20, in which an individual could receive a deep dose equivalent > 0.1 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation) shall be controlled as described below to prevent unauthorized entry.

a. Each area shall be barricaded and conspicuously posted as a high radiation area. Such barricades may be opened as necessary to permit entry or exit of personnel or equipment.

b. Entrance shall be controlled by requiring issuance of a Radiation Work Permit (RWP) or equivalent that includes specification of radiation dose rate in the immediate work area(s) and other appropriate radiation protection equipment and measures.

c. Individuals qualified in radiation protection procedures or personnel continuously escorted by such individuals may, for the performance of their assigned duties in high radiation areas, be exempt from the preceding requirements for issuance of an RWP or equivalent provided they are otherwise following plant radiation protection procedures for entry into, exit from, and work in such high radiation areas.

d. Each individual or group of individuals permitted to enter such areas shall possess, or be accompanied by, one or more of the following:

1. A radiation monitoring device that continuously indicates the radiation dose rate in the area.

2. A radiation monitoring device that continuously integrates the radiation dose rate in the area and alarms when a preset setpoint is reached. Entry into high radiation areas with this monitoring device may be made after the dose rate in the area has been determined and personnel have been made knowledgeable of it.

3. A radiation monitoring device that continuously transmits dose rate and cumulative dose information to a remote receiver monitored by radiation protection personnel responsible for controlling personnel radiation exposure within the area.

4. An individual qualified in radiation protection procedures equipped with a radiation dose rate monitoring device. This individual shall be responsible for providing positive radiation protection control over the activities within the area and shall perform periodic radiation surveillance at the frequency specified by radiation protection supervision.

6.11.2 In addition to the requirements of Specification 6.11.1, high radiation areas in which an individual could receive a deep dose equivalent > 1.0 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation), but less than 500 rads/hour (at 1 meter from the radiation source or from any surface penetrated by the radiation) shall be provided with a locked or continuously guarded door, or gate, or equivalent to prevent unauthorized entry.

a. The keys to such locked doors or gates, or equivalent, shall be administratively controlled in accordance with a program approved by the radiation protection manager.

b. Doors and gates, or equivalent, shall remain locked except during periods of access by personnel under an approved RWP, or equivalent, to ensure individuals are informed of the dose rate in the immediate work areas prior to entry.

c. Individual high radiation areas in which an individual could receive a deep dose equivalent> 1.0 rem in one hour (at 30 centimeters from the radiation source or from any surface penetrated by the radiation), accessible to personnel, that are located within larger areas where no enclosure exists to enable locking, or that are not continuously guarded, and where no lockable enclosure can be reasonably constructed around the individual area require both of the following access controls:

1. Each area shall be barricaded and conspicuously posted.

2. A flashing light shall be activated as a warning device.

Attachment 4 to TMI2-RA-COR-2021-0002

License Amendment Request

Three Mile Island Nuclear Station, Unit 2

NRC Possession Only License No. DPR-73

List of Regulatory Commitments

The table included in this attachment identifies the regulatory commitments in this document. The type of commitment and associated schedule for implementation are provided. Any other statements in this submittal represent intended or planned actions. They are provided for information purposes and are not considered to be regulatory commitments.

The following list identifies those actions committed to by the Applicant identified in this letter ("License Amendment Request – Three Mile Island, Unit 2, Decommissioning Technical Specifications"). Any other actions discussed in the submittal represent intended or planned actions by the Applicant. They are described only as information and are not Regulatory Commitments. Please notify Gerry van Noordennen, TMI-2 Solutions, LLC Senior Vice President, Regulatory Affairs, at 860-462-9707 of any questions regarding this document or associated Regulatory Commitments.

REGULATORY COMMITMENT	TYPE		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
The TMI-2 PDMS SAR will be updated to address the HIC fire accident.	X		Prior to performing major decommissioning
TMI-2 will develop a Radiation Protection Program (RPP) and associated implementing procedures.		X	Prior to performing major decommissioning
Airborne radiation monitoring will be provided to monitor containment openings for airborne radioactivity.		X	Prior to performing major decommissioning
A hoisting and rigging program will be developed.		X	Prior to performing major decommissioning
A lift plan will be developed for all lifts as directed by the hoisting and rigging program.		X	Prior to performing major decommissioning

Attachment 5 to TMI2-RA-COR-2021-0002

License Amendment Request

Three Mile Island Nuclear Station, Unit 2

NRC Possession Only License No. DPR-73

Safe Fuel Mass Limits Calculation

This attachment presents calculation TMI2-EN-RPT-0001 "Determination of the Safe Fuel Mass Limit for Decommissioning TMI-2." This calculation provides the basis to increase the SFML from 42 kg to 1200 kg. This calculation demonstrates that the remaining core debris material cannot be configured into an arrangement whereby a criticality event is possible.

ENERGYSOLUTIONS	**Calculation Package**	Doc. No.: TMI2-EN-RPT-0001 Rev.: Rev 0
Title: Determination of the Safe Fuel Mass Limit for Decommissioning TMI-2		
Design Plan No.: TMI2-DPL-N-00-0001	DP Rev.: 1	

Signatures	(printed name, signature, date)
Preparer	Digitally signed by Megan Pritchard Date: 2021.02.10 14:47:24 -06'00'
Approval	Digitally signed by Guy Rhoden DN: cn=Guy Rhoden, c=US, o=NS-TS, email=guy.rhoden@ns-ts.com Date: 2021.02.10 13:13:54 -08'00'

Record of Verification

Item Verified	Acceptable	N/A - Explain
a) Design Verification by Independent Checking Method	☒	☐
b) Computer Software approved per CG-EN-PR-204	☒	☐
c) Calculation Package complete and per CG-EN-PR-203	☒	☐
Signature	*(printed name, signature, date)*	
Verifier	Digitally signed by Derrick Faunce DN: cn=Derrick Faunce, o=NSTS, ou=NCS, email=derrick.faunce@ns-ts.com, c=US Date: 2021.02.10 15:58:19 -05'00'	

Record of Revisions

Rev.	Affected Pages	Affected Media	Description	(Print or Type)	
				Preparer	Verifier
0	-	-	Initial Issue	Megan Pritchard	Derrick Faunce

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1. INTRODUCTION

1.1. Purpose and Objectives

The purpose of this calculation and report is to identify a new safe fuel mass limit (SFML) for Three Mile Island (TMI)-2 decommissioning based on realistic but bounding assumptions about the material within the reactor vessel and outside the reactor vessel. It is intended that a single SFML can be utilized for all work in TMI-2 decommissioning and bound all credible operational upsets. This is accomplished through examination and application of material sampling results (i.e., impurities concentration), application of conservative assumptions where conditions are unknown or have associated uncertainty (i.e., fuel geometry, reflector), and taking credit for known phenomena (i.e., radioactive decay, burn-up). The sensitivity of each parameter to overall system reactivity is analyzed such that a balance between known and less certain parameters can be achieved. Documentation and supporting information for the inputs utilized to derive the SFML is outlined in TMI2-EN-RPT-0003, *TMI-2 Safe Fuel Mass Limit Computational Input Consensus* (Ref. [1]).

1.2. Background

1.2.1. Safe Fuel Mass Limit

The SFML is a limit developed through criticality safety analyses as to the amount of fuel-containing debris that may be safely handled at one time. It is intended that this limit bound all remaining fuel-containing debris in the TMI-2 reactor that is subject to decommissioning operations.

Previous defueling operations were performed using SFMLs developed based solely on credible upper bounds for input parameters as opposed to sample data or realistic conditions. However, defueling operations included potential removal of relatively intact fuel rods and fuel debris that varied extensively in its composition. This revision to the SFML is performed with more realistic and less conservative inputs than those used in previous analyses. The primary reasoning behind this approach is that the fuel debris is largely confined to an area with available characterization data, and intact fuel rods are no longer present. These inputs, while less conservative than those used in the original SFML determination, are still considered to be reasonably and sufficiently conservative for their use herein.

1.2.2. Status of TMI-2

The TMI-2 reactor has been undergoing various stages of defueling and clean-up since the accident in 1979. The primary defueling occurred in the late 1980s. The operations removed all fuel to the extent reasonably achievable and ultimately reduced the possibility of an inadvertent criticality under static or accident conditions. Approximately 99% of the original core inventory was removed during these operations with an estimate for residual UO_2 of 1097 kg (~1.2% of initial TMI-2 inventory). The remaining fuel is in the form of finely divided, small particle-size sediment material; re-solidified material either tightly adherent to components or in areas inaccessible to defueling; and adherent films on surfaces contained within piping, tanks, and other components. The 1097 kg includes fuel debris inside and outside the reactor vessel (RV) with the bulk of the mass residing in the lower head of the RV.

The remaining fuel mass estimates in each major area are provided in Table 1-1. During defueling, the majority of the material in the debris bed of the core was removed. Approximately 12% of the remaining material is estimated to be in the coolant system with some scattered throughout the plant (e.g., steam generators, hot legs, coolant pumps). Evaluation of the ex-vessel residual fuel has demonstrated that no discrete (neutronically de-coupled) location has in excess of 127 kg UO_2, and the total estimate outside of the RV is 170 kg UO_2.

Table 1-1. Remaining Fuel Mass Estimates (Ref. [2], Table 1)

Area	**Estimated Mass ($kg\ UO_2$)**	**Uncertainty ($kg\ UO_2$)**
Plenum	2.1	± 1.9
Letdown Coolers	3.7	± 2.0
Pressurizer	0.3	± 0.2
Reactor Vessel Head	1.3	± 0.9
Reactor Building Basement	1.3	± 0.7
'A' and 'B' Once Through Steam Generator (OTSG)	62.3	± 9.7
Auxiliary and Fuel Handling Buildings	11.5	± 5.8
Reactor Building Miscellaneous Components	64.0	± 26.9
Reactor Coolant System (RCS)	25.8	± 11.1
Reactor Vessel	925	± 370
Total	1097	± 371

Detailed summaries as to how each of these estimates were developed can be found in TMI2-EN-RPT-0003, *TMI2 Safe Fuel Mass Limit Computational Input* Consensus (Ref. [1], §2). Some of the residual quantities included in the estimates are reported as the minimum detectable level, indicating that the measurement technique did not detect a statistically significant number of events (counts) related to fissile nuclides. Physical measurements are subject to imprecisions which is an additional contributor to uncertainty. There are also uncertainties associated with counting statistics. The estimate for residual UO_2 is intended to be an upper bound, but carries an uncertainty in the RV of ± 370 kg UO_2 (Ref. [4]). Including the uncertainty in the estimated mass for the RV results in a total for this area of ~1295 kg UO_2.

1.3. Scope

The existing SFML is the fissile material mass limit for handling within the reactor vessel. The revised SFML derived herein applies to all decommissioning operations including removal from the RV, movement to the reactor cavity or other area intended for segmentation and movement to loading of the transportable storage container (TSC). Once fissile material (in actuality, these are components with damaged core material) is loaded into the TSC, it it outside the scope of the applicable SFML.

2. METHODOLOGY

2.1. General

The SFML is revised through evaluation of planned decommissioning operations and associated operational upsets, remaining fuel estimates, and the associated computation of a bounding mass limit that may be applied to those operations. Inputs to the supporting calculation are supported through review of robust historic sampling data and the conservative application of those results.

2.2. Computational

The approach to developing a new SFML encompasses two computational efforts: first, calculation of the source term (i.e., expected fuel composition) in 2022; and second, the criticality calculations for limiting reactor core fuel arrangements. Analytical software is qualified according to EnergySolutions Quality Assurance Program.

2.2.1. Computer Codes

Derivation of the expected source term is performed using the SCALE 6.2.4 ORIGEN depletion code to decay the previously calculated burned fuel. ORIGEN uses the continuous energy ENDF/B-VII decay data in the decay calculation (SCALE: A Comprehensive Modeling and Simulation Suite for Nuclear Safety Analysis and Design, Ref. [6]).

The criticality results in this report are calculated using Monte Carlo methods in the Monte Carlo n-Particle (MCNP) Version 6.2 code (Ref. [7]) with continuous energy ENDF/B-VIII.0 cross section data (Ref. [8]). MCNP is a general-purpose Monte Carlo particle transport code that can be used for neutron transport. MCNP treats an arbitrary three-dimensional configuration of materials in geometric cells bounded by first- and second-degree surfaces and fourth-degree elliptical tori. The code can be used to perform nuclear criticality safety analyses (k_{eff} eigenvalue calculations). The calculation of the neutron multiplication factor is performed by solving the neutron transport equation as an eigenvalue problem through the employment of Monte Carlo techniques.

2.2.2. USL Determination

Computer codes used to determine the effective neutron multiplication factor, k_{eff}, are to be properly verified and validated in accordance with ANSI/ANS-8.24 (Ref. [9]). The methodology used in the validation is taken from NUREG/CR-4604 (Ref. [10]) and NUREG/CR-6698 (Ref. [11]).

Calculations are performed to validate MCNP v6.2 nuclear analysis code for neutron multiplication factor calculations performed in support of raising the SFML for TMI-2 decommissioning. The validation is applicable to heterogeneous spherical and annular configurations of low enriched UO_2 and water.

The bias determination report identifies applicable experiments to determine the bias and bias uncertainty for the geometric configuration, enrichment, fissile material distribution, impurity content, and potential soluble poison concentration included in the modeling. The bias and bias uncertainty is then used in combination with an estimate of the margin of subcriticality (MoS) to determine a USL such that for the specific application, calculated reactivity values, k_{calc}, and their associated Monte Carlo uncertainty σ satisfy the relation

$$k_{calc} + 2\sigma < USL$$

This ensures that a system is safely subcritical, in this case at a 95% confidence level. The USL is established by subtracting quantified estimates of the code bias, bias uncertainty, and additional margin from unity.

$$\text{USL} = 1 - \text{Calculational Margin} - \text{Margin of Subcriticality}$$

The ANSI/ANS-8.24-2017 standard (Ref. [9]) defines the following terms:

Bias	The systematic difference between calculated results and experimental data. Note by convention the bias is determined as the calculated value minus the experimental value. Hence, a negative bias indicates that the code underpredicts the experimental result.
Bias Uncertainty	The uncertainty that accounts for the combined effects of uncertainties in the experimental benchmarks, the calculational models of the benchmarks, and the calculational method.
Calculational Margin	An allowance for Bias and Bias Uncertainty plus considerations of uncertainties related to interpolation, extrapolation, and trending.
Margin of Subcriticality	An allowance beyond the calculational margin to ensure subcriticality.
Validation Applicability	A domain, which could be beyond the bounds of the benchmark applicability, within which the margins derived from validation of the calculational method have been applied.

Method

The bias determination is performed in direct support of the SFML work and consists of two parts. The first involves the determination of the MCNP v6.2 computer code bias and bias uncertainty. The second part examines the area of applicability (AOA) of the validation benchmark cases. The benchmarks represent a selection of uranium based critical experiments that are determined to be representative of the configurations modeled as part of this report. The benchmark data is examined for potential trends to determine the proper bias determination method. The selection of benchmark cases and calculated bias are reported in TMI-EN-RPT-0002, *MCNP Version 6.2 Bias Determination for Low Enrichment Uranium Using the ENDF/B-VIII.0 Cross Section Library* (Ref. [12]).

The AOA consists of the range or values of various parameters important to the reactivity of the benchmark models. These define the range or values for a system parameter or parameters over which the validation and bias presented above are considered valid without modification. The parameter ranges of the validation models are compared to the models of the system being evaluated. If the system parameter falls within the AOA, no additional margin is necessary beyond the MoS for determining the USL. If one or more of the system parameters are found to fal outside of the AOA, additional margin may be added on the USL to extend the applicability of the validation.

Analysis and Result

The bias determination report validates the use of MCNP Version 6.2 and ENDF/B-VIII.0 library for use in performing the calculations that estimate k_{eff} values for determination of the SFML. There is no notable trend within the data that needs to be compensated for in the determination of the bias, which is calculated as 0.9798. The AOA of the validation is provided in Table 2-1 and is generally sufficient to cover the range of parameters in the SFML calculation.

Table 2-1. Properties of the MCNP6 Benchmark Models

Property	Validated AOA				
Fissile Materials	U (2 – 10 wt. % ^{235}U) in the form compound, solution				
Basic Geometry of the Fissile Material	Array of fuel rods, rectangular parallelepipeds, UO_2 in cube in cubic array, cylinder, sphere, slabs				
Moderator Materials	Water, Paraffin, Polyethylene				
Reflector Materials	None, Water, Acrylic, Steel, Plexiglas, Paraffin, Polyethylene, Concrete				
Other Significant absorbers, poisons, or structural materials present	Al alloys, steel, borated steel, Boral, boroflex, Ag-In-Cd, Cu, Cu with Cd, Cd, Zircaloy-4, rubber Soluble Boron: 0 – 96 ppm				
Specific Cross Sections and S(α,β) used (MCNP6 identifiers)	1001.00c 5010.00c 5011.00c 6012.00c 6013.00c 7014.00c 8016.00c 8017.00c 9019.00c 11023.00c 12024.00c 12025.00c 12026.00c 13027.00c 14028.00c 14029.00c 14030.00c 15031.00c 16032.00c 16033.00c 16034.00c 16036.00c 17035.00c 17037.00c	19039.00c 19040.00c 19041.00c 20040.00c 20042.00c 20044.00c 20046.00c 20048.00c 22046.00c 22047.00c 22048.00c 22049.00c 22050.00c 24050.00c 24052.00c 24053.00c 24054.00c 25055.00c 26054.00c 26056.00c 26057.00c 26058.00c 27059.00c	28058.00c 28060.00c 28061.00c 28062.00c 28064.00c 29063.00c 29065.00c 30064.00c 30066.00c 30067.00c 30068.00c 30070.00c 40090.00c 40091.00c 40092.00c 40094.00c 40096.00c 42092.00c 42094.00c 42095.00c 42096.00c 42097.00c 42098.00c 42100.00c 47107.00c 47109.00c	48106.00c 48108.00c 48110.00c 48111.00c 48112.00c 48113.00c 48114.00c 48116.00c 49113.00c 49115.00c 50112.00c 50114.00c 50115.00c 50116.00c 50117.00c 50118.00c 50119.00c 50120.00c 50122.00c 50124.00c 92234.00c 92235.00c 92236.00c 92238.00c	h-poly.40t h-h2o.40t
Average Energy of Neutrons Causing Fission (AENCF)	Range (MeV): 2.43E-02 – 2.88E-01 Average (MeV): 1.40E-01				

A single USL is developed for the SFML application for TMI-2 decommissioning. The USL is derived based on the calculated bias using the limiting identified geometric configuration (sphere), fissile material type (low enriched $^{235}UO_2$), soluble poison concentrations (0 – 96 ppm), and distribution (heterogeneous) for the pertinent models. The additional MOS applied is 0.0298 for an overall USL of 0.95. This MOS is justified through the application of conservative input parameters and bounding configurations to the computational models.

A USL of 0.95 is utilized in the criticality safety analysis and provides adequate margin in supporting the SFML.

3. PROCESS DESCRIPTION

3.1. Operational Description

There are four main areas of core debris in TMI-2. The Reactor Pressure Vessel (also called RV), the Reactor Coolant System (not including the RV), the Reactor Building (not including the RV and Reactor Coolant System), and the Auxiliary/Fuel Handing Building. Table 1-1 provides estimates for these areas, broken down into some smaller areas/systems. Each of the four general areas is handled separately during decommissioning.

Prior to the removal of any RV components, the RV and reactor cavity are flooded with water. The types of components to be removed from the RV include core barrel remnants, the thermal shield, and the lower core support plate remnants. After removal of the main components, instrument nozzles and penetrations are cut and moved to the reactor cavity for loading into the transportation containers. All remaining debris material in the RV following removal of the main components and cut pieces is vacuumed or cleaned up by other mechanical means (e.g., scoops, jaw-type tools).

These components are associated with adhered and non-adhered (i.e., loose) debris material. The three types of debris material (also called damaged core material) associated with the TMI-2 core debris are:

- Type-1 Core Debris – Loose debris consisting of finely-divided, small particle size material;
- Type-2 Core Debris – Surface films consisting of thin films of debris material of varying depth on systems, structures, and components, and;
- Type-3 Core Debris – Re-solidified material and fuel assembly artifacts (average density of 7.1 g/cm^3)

Components with tightly adhered debris material are cut up to fit into open design liner/canisters (TSCs) that are compatible with the existing Dry Cask Storage System. Loose debris material chips, and fine granular material are scooped or vacuumed and captured in filter cans that are loaded into TSCs that are also compatible with the existing Dry Cask Storage System. The weight limit for the TSC is 55,000 lbs and they are expected to be loaded to approximately 95% efficiency for a waste weight of 52,250 lbs. Once the debris material is loaded into the TSCs, the remaining packaging process is identical to a conventional spent nuclear fuel assembly dry storage campaign.

As the components and associated debris are removed, they are moved to another under water location within the reactor cavity for segmentation and loading into a TSC. Fourteen (14) TSCs are anticipated to be used during the entire operation and multiple are available to receive segmented debris at any one time, which are loaded based on packaging efficiency and/or debris type. Following segmentation, any recovered Type-1 and Type-3 materials from that area during cleanup are loaded into a separate TSC intended for fines and chips collection.

Following cleaning of the RV, the Type-1 and Type-3 debris material in the Once Through Steam Generators is cleaned out and moved to the dry area of the reactor cavity for loading into the TSCs. Lastly, there is also the Auxiliary/Fuel Handing Building with an estimated 11.5 kg of debris material. This material is also moved to the reactor cavity and loaded into the TSCs.

Only one TSC is removed at a time by placing it into the Dry Storage Canister located inside the Transfer Shield. Once all TSCs are loaded and removed from the reactor cavity, the RV is drained of the remaining water. Loaded TSCs inserted into the Dry Storage Canister are moved from the loading location to a handling facility. Here, the Dry Storage Canister lid is welded on, the Canister is vacuumed dried and backfilled with inert cover gas.

3.2. Normal Conditions

Under anticipated normal conditions, all the of remaining core debris (i.e., fissile material) consists of the three types listed above in the general locations listed in Table 1-1. The total amount of expected fissile material for the entire decommissioning is estimated to be about 1097 kg of irradiated and subsequently decayed UO_2 (i.e., spent fuel) with, on average, 16 wt.% impurities in the fuel debris. Boron is expected to be in the impurities at an average concentration of 0.11 wt.% of the fuel debris. Borosilicate glass is expected to be present in the lower head of the RV.

The four main areas (RV, RCS, Reactor Building, Auxiliary/Fuel Handling Building) are distinctly different and physically separated within the reactor building. Each area (e.g., RV) has specific reactor components (e.g., lower grid assembly [LGA]) or areas made up of components (e.g., the plenum) with an estimated mass. These estimates can be used to visualize a high level packaging plan with some degree of certainty. Some components do not have estimates for the mass or volume so the Canister estimates in the high level packaging plan have relatively high uncertainty.

The segmentation and loading of TSCs occurs in the reactor cavity where material is transported to after it is removed from its current location. For the majority of component segmentation, it will occur under water in a flooded reactor cavity. Some segmentation (like the OTSG components) may not occur under water and may be on a concrete platform. Additionally, some components may be set on concrete at some time during the operations. For this reason, the reactivity addition from a tight fitting concrete reflector is examined.

Material and component removal from each area is treated as a separate operation, meaning that debris from two areas is not removed at the same time; however, a partially filled TSC from one area may remain for loading from the next facility area if there is remaining void space. Estimates for the number of TSCs for each area based on estimated weight and packing efficiency are provided in Table 3-1.

Table 3-1. Canister Estimates from High Level Cutting and Packaging Plan

Component/Area	Estimated TSCs	Note
LGA, Core Support Assembly (CSA)	3.95 (4)	Assuming payload packing efficiency of 95%. LGA and CSA are majority of Plenum.
Remaining plenum	2.07 (3)	Remainder of 3rd canister may be filled with excess LGA and CSA.
Flow Distributor and ICI Guide Tubes	1	In the "A" D-ring
OTSG	3	
Chip collection	2	Approximately 6,000 lbs
Auxiliary and Fuel Handling Building	1	
Total	**14**	

The design inputs, and specifically reference information, provided in Section 4 and detailed in TMI2-EN-RPT-0003, *Safe Fuel Mass Limit Computational Input Consensus* (Ref. [1]) serves as the basis to develop inputs to the computational models to develop the SFML. The values for input parameters include varied uncertainties: those that are well understood/accepted, those that have some uncertainty, and those that have larger uncertainties. The parameters include ^{235}U enrichment, impurity content, fuel debris composition, UO_2 density, etc. For several input parameters, the selected value is credibly bounding.

Development of the SFML includes optimization of parameters for maximum moderation, reflection and interaction conditions in a bounding geometry (sphere). Using a sphere as the material geometry for SFML minimizes the surface area to volume ratio and does not require taking credit for the distribution of the fuel debris.

4. INPUTS

Over the years since samples were retrieved at TMI-2 and analyzed at various laboratories, substantial effort has been put into using those results to inform operational decontamination and decommissioning (D&D) decisions, validate accident computer codes, estimate fission product release, and understand the nature of the TMI-2 accident. The majority of that work was used for duefueling operations, which occurred in the late 1980s. For the purposes of deriving a SFML for intended D&D operations, the sample results biased toward the bulk of the remaining material are used to develop compuatational input parameters.

The input parameters for consensus include core debris composition (i.e., impurities concentration), fuel enrichment, fuel density, fuel burn-up and resulting composition, fuel pellet geometry, and modeling geometry, including moderation and reflection conditions. Discussion of each of these parameters is provided in TMI2-EN-RPT-0003 (Ref. [1]). Those that rely on historic references (primarily impurities content from sampling and debris composition) are summarized here.

4.1. Design Inputs

Inputs to the design of the SFML come from a combination of historical documents, reactor operation history, previous decommissioning operations, and planned future decommissioning operations. Planned future decommissioning operations, which support the criticality not credible argument for application of the SFML, are laid out in Section 3. The pertinent design input information that feeds into the calculation is further discussed in this section. Inputs that are adjusted as part of the parametric study associated with this calculation (i.e., geometry, enrichment) are in Section 5.

A graded approach is used to apply the design input information to the development of the SFML, which depends on the strength of the basis of that information. For example, known natural phenomena, such as radioactive decay, are applied more assertively than a parameter with less assurance (e.g., exact impurity content) which is applied more judiciously.

4.2. Sampling and Impurities

Samples were retrieved from multiple locations including the lower head region, the core debris bed, and the B-loop steam generator tube sheet, which are summarized here. Note that for each sample retrieved, it was processed into particles which were then analyzed individually. One sample can have multiple particles of varying sizes and elemental makeup.

4.2.1. Reference Data for Lower Vessel Head

In 1985, prior to defueling, 16 particles of debris from the lower reactor vessel (i.e., lower head) were obtained through the annulus. Although the analyses were performed prior to defueling, most of the remaining material is in the same region as the analyzed samples. The samples were intended to be both representative of the region "typical material" and a material that "looked different." The data indicate that the composition of the debris is similar to what would be expected if the principal components of the original core were mixed, melted, and a fraction subsequently relocated to the lower plenum of the reactor. The general appearance of the lower plenum debris and the microstructure of the samples indicate that they were once molten. The particles of pure UO_2 have changes in porosity that indicate it may have been near the melting point (GEND-INF-084, *Examination of the Debris from the Lower Head of the TMI-2 Reactor* Ref. [13]).

Boron was found in measurable concentrations ranging from 0.066 wt.% to 0.36 wt.% on average per debris sample. Gadolinium poison was not readily identifiable in the lower head debris but was more prevalent in the core debris bed. The structural material element with the highest concentrations in the lower head was iron, ranging from 1.8 to 3.7 wt.% average per debris sample.

For additional summary information on the sample analyses, refer to TMI2-EN-RPT-0003 (Ref. [1]), and for the original analytical information refer to GEND-INF-0084, *Examination of Debris from the Lower Head of the TMI-2 Reactor* (Ref. [13]).

4.2.2. Reference Data for Core Debris Bed

A substantial amount of core debris bed was removed during defueling in the late 1980s. Prior to the defueling, a sampling of core debris from the center and radius was performed in 1983-1984, removing material from three depths: surface of the rubble bed, 3 inches deep into the bed, and 22 inches deep into the bed. A summary of the results is provided below. For reference, the as-built TMI-2 active core region contained about 94.5 wt.% UO_2 + Zr-4 and approximately 2.3 wt.% stainless steel + Inconel. The U/Zr ratio for the active core region was about 3.6.

- The average, normalized, U content was 82.6 wt.%, Zr content was 13.9 wt.%, Fe content was 2.7 wt.%, and Ni content was 0.9 wt.%. The U/Zr ratio was higher than as-built (~5.9) and the Ni, Cr, and Fe was about 1.3 wt.% higher than as-built.
- The degree of mixing and relocation suggests that molten core materials mixed vigorously to produce the degree of homogeneity observed.
- Original as-built uraniuim enrichment for specific fuel assemblies had no correlation to sample results, indicating significant physical relocation of the fuel.

4.2.3. Reference Data for Steam Generator Tube Sheet

Examination of loose core debris from the B-loop steam generator upper tube sheet was part of a fission product inventory evaluation and also provided insight into the deposition of core material outside the reactor vessel. The sample appeared similar to the sample below the surface of the core debris bed, and some of the particles in the lower plenum.

The sample particles were reaction products consisting primarily of U and Zr oxides. Fe, Ni, and Cr were trace elements within the matrix. Two of the 12 particles indicated control rod origen (i.e., Ag, In, and Cd).

4.3. Fuel Debris Composition

References [13], [14], and [15] analytically estimate the peak and sustained temperatures in the core in order to better estimate fission product release and fuel composition. It is estimated that about 20% of the core material in the debris bed experienced temperatures up to fuel melting. The lower plenum material could have attained temperatures of at least 2810 K.

The only historical report that provides the explicit burned composition of the fuel (UO_2 component of the debris) is the 1989 *Criticality Safety Evaluation for Increasing the SFML* (Ref. [16]), which is provided as an attachment to the Defueling Completion Report (Ref. [3]). This composition accounts for burnup effects in all three fuel batches but no melted and comingled cladding or structural material (i.e., impurities) as described above. Comparisons of the calculated fission product composition with the analytical data indicated, at that time, that the calculational results were appropriate (Ref. [13]).

In each batch, the effects of uranium depletion, fissionable plutonium generation, and rare earth fission product production are considered. The base fuel composition input previously used is provided in Table 4-1. However, because this composition was derived 30-plus years ago, as part of this calculation, it is computationally decayed to the year 2022. The new composition is discussed in Section 5.3.1 as an input to this calculation.

Table 4-1. Burned Fuel Composition (Ref. [16])

Isotope	Number Density (atoms/barn-cm)
^{235}U	5.21E-4
^{238}U	2.25E-2
^{16}O	4.60E-2
^{239}Pu	4.01E-5
^{240}Pu	2.00E-6
^{241}Pu	2.49E-7
^{149}Sm	1.01E-7
^{151}Sm	1.79E-7
^{151}Eu	8.20E-9
^{153}Eu	1.32E-7
^{154}Eu	4.51E-9
^{155}Eu	6.12E-9

4.4. Reference Data Summary

For the purposes of calculating a final SFML, general conclusions can be drawn from the abundance of analytical sample information, particularly that available for the lower head of the reactor vessel.

- The previously derived fuel composition was adequate as a reference composition for burn-up of the original TMI-2 fuel. This composition serves as a starting point to decay each isotope to the year 2022 in order to develop a current fuel composition.
- Impurities, whether from cladding, structural material, or control rods, exist throughout the TMI-2 core. Control rod material was not as commonly found in remaining core debris as structural material.
- The U/Zr compositions in the core are indicative of mixing of all core constituents.
- Boron is evenly distributed throughout sample particles at the same concentration as in the reactor coolant, although it is not known if the elemental boron originated in the coolant or poison rods.
- Gadolinium is distributed among the debris bed material at similar concentrations to the original burnable poison rod loading, indicating vast mixing. Gadolinium was not readily

identified in the lower head or steam generator tube sheet as it was heavily concentrated in the core crusts.

- Most of the control rod material accumulated in the core debris bed or elsewhere, not in the lower head region.
- Temperatures during the accident reached levels to initiate and propagate core melting, peaking at greater than 2800 K. There are few examples of pure UO_2, indicating isolated temperatures greater than 3100 K.
- Mixing of different assemblies' enrichment has occurred, and little or none of the 2.96 wt.% $^{235}U/U$ is contained in the lower head region. The average enrichment of the 34 samples collected in the lower head is 2.23 wt.% $^{235}U/U$.
- Core debris density ranges from about 6 g/cm^3 to less than 9 g/cm^3.

5. CALCULATIONS

5.1. Model Geometry Description

A single criticality model was developed using bounding and anticipated configurations of the remaining spent fuel. A spherical configuration of all remaining spent fuel was filled with a lattice of fuel and moderator. A hexagonal lattice was selected because of the ability to closely pack the fuel elements. Each spherical fuel element is surrounded by water on all sides. The size of the fuel element and spacing between each fuel element (i.e., the H/U ratio) is modified for each base arrangement in order to optimize reactivity in each study. The optimum configuration of fuel and moderator (i.e., H/U ratio) is dependent on multiple parameters and can change with the addition of absorbers to either the fuel or moderator. This adjustment has no physical basis. It is merely a means to maximize the fuel/water intereaction and is bounding of any credible configuration of the material. The base arrangements optimized for further analysis are:

- Sphere with lattice of fuel debris with impurities; pure water moderator and reflector;
- Sphere with lattice of fuel debris; poisoned water moderator and pure water reflector;
- Sphere with lattice of fuel debris with impurities; poisoned water moderator and pure water reflector.

For comparison, a sphere with lattice of fuel debris (no impurities) and pure water as a reflector (no poison) and moderator is also included.

The spherical model assumes all modeled fuel and moderator is in a spherical configuration, surrounded by a close-fitting essentially infinite water reflector. The moderator to fuel ratio is optimized in each base case to achieve the highest reactivity prior to further perturbations on model parameters (e.g., fuel mass). This optimization is done by altering the pitch of the lattice for each unit cell. A graphical depiction of the cross-sectional unit cell lattice is provided in Figure 5-1. The blue area represents the fuel pellet and the red represents the moderator. The hexagonal region surrounding each cell is not a physical attribute but only a computational cell place-holder.

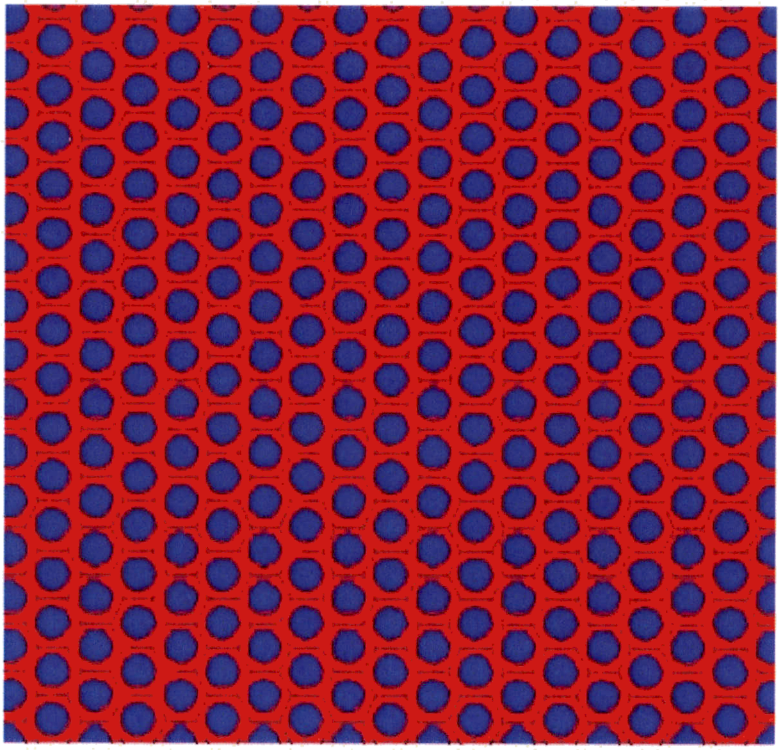

Figure 5-1. Cross Section of Fuel Region Lattice

A graphical depiction of the cross section of the spherical model is provided in Figure 5-2. The interior shaded region is the fuel region lattice and the surrounding red is the effectively infinite reflector.

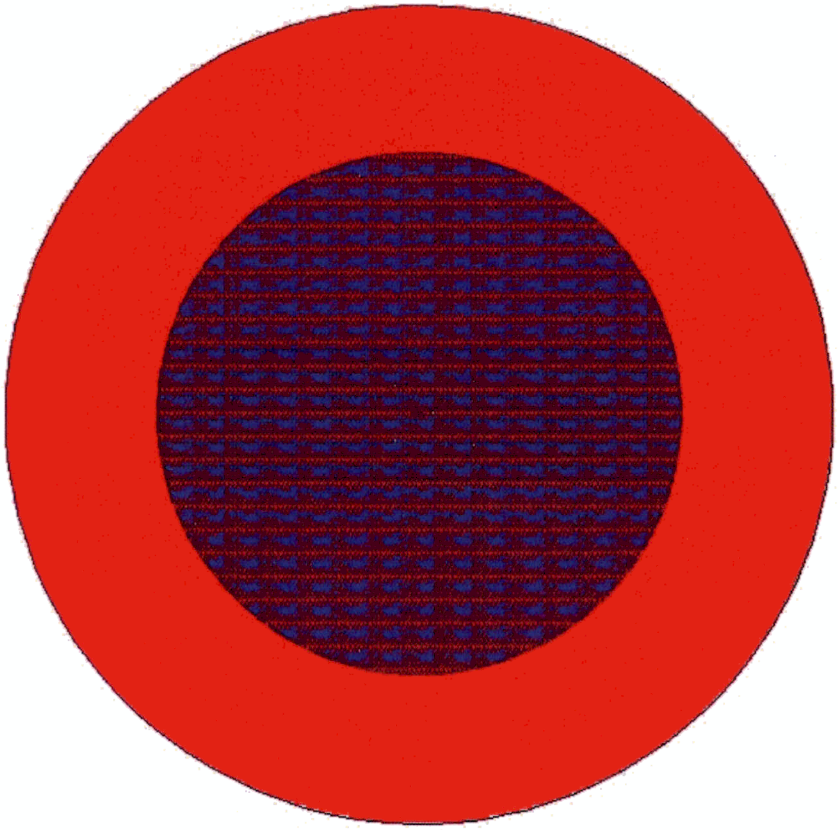

Figure 5-2. Cross Section of Spherical Full Core Model

For each optimized configuration, the total uranium mass, percentage of impurities, and concentration of boron in the water were varied. Sensitivity to a lowered UO_2 density and concrete reflector were also examined on the most limiting configurations. The effect of a lowered UO_2 density was within the margin of error and had little effect of k_{eff}. In all examined cases, the higher UO_2 density was bounding. A concrete reflector is slightly more reactive than the equivalent thickness water reflector. This sensitivity is discussed as an upset condtion in Section 5.4.3.

The range of parameters studied for the spherical configuration are provided in Table 5-1. Parameters such as fuel pellet radius, unit cell separation, and UO_2 density were used as part of scoping calculations to identify an optimum configuration. Once that optimum configuration was identified, uranium mass, impurity weight fraction, boron concentration, and reflector material were adjusted for the reported results. Note that 30 cm of reflection is effectively infinite.

Table 5-1. Parameters and Ranges Examined

Parameter	Range
Uranium Mass	925 kg – 1750 kg
Reflector Thickness	30 cm
Reflector Material	Water, Concrete
Impurity Weight Fraction	5% – 16.21%
Boron Impurity Percentage	10% – 100%
Iron Percentage	90%
UO_2 Density	10.55 – 10.97 g/cm^3
Fuel Pellet Radius	0.2 cm – 0.6 cm
Unit Cell Separation	0.2 cm – 0.4 cm

5.2. Model Assumptions

Because the distribution of the fuel within the RV is unknown, the SFML is derived through bounding assumptions intended to cover any credible upset conditions. The geometric configuration of the fuel is bounding in the spherical model. An annular model was studied previously and shown to be less reactive than the spherical model (NSTS-ES-01 Ref. [17]). The fuel pellet is spherical, the moderation is optimized, and the fuel region is spherical. This represents a worst-case configuration for the fissile material. Additionally:

- The fuel pellet volume is assumed to be close to that of a standard sized fuel pellet; although a sphere and in a hexagonal lattice;
- The fuel is represented as TMI-2 average fuel (i.e., a homogeneous mixture of the three fuel batches), as discussed in Section 5.3.1;
- An effectively infinite reflector is assumed;
- No credit is taken for existing structural or solid poison materials (e.g., borosilicate glass);
- Only limited credit is taken for the presence of fission product poisons.

5.3. Material Descriptions

5.3.1. Fissile Material

The fissile material is represented as a homogeneous medium assumed as TMI-2 average fuel. The homogeneous medium is a mixture of the three known fuel batches and this is considered conservative because defueling data indicates that most of the batch 3 fuel (at least ~65%), with the highest initial enrichment of 2.96 wt.% has been removed from the RV. Consequently, any remaining fuel is expected to consist primarily of batch 1 and 2 fuel with 1.98 wt.% and 2.64 wt.% enrichment, respectively.

The composition of the UO_2 component[1] is derived by starting with the composition supplied in the Defueling Completion Report SFML calculation attachment (Ref. [3], Table 5-8). This composition accounts for burnup effects in all three fuel batches through application of a conservative approach to burnup credit. In each batch, the effects of uranium depletion, fissionable plutonium generation, and rare earth fission product production are considered. The gaseous fission products were assumed to be released at the time of the accident and the soluble ones were assumed to have leached out of the fuel matrix. Of the remaining non-soluble fission products, some become volatile under extremely high fuel temperatures and the formation of a zircaloy-fuel eutectic and, thus, were assumed not to remain within the fuel matrix. Of the non-soluble fission products, only the rare earths were considered to be stable under TMI-2 accident conditions. The validity of the presence of rare earth elements, which serve as significant neutron poisons, is discussed extensively in Appendix B of Reference [18] (*Reactor Coolant System Criticality Report*).

The unburned fuel enrichments for the three batches were 1.98 wt.% (56 assemblies), 2.96 wt.% (60 assemblies) and 2.64 wt.% (61 assemblies) $^{235}U/U$. As a homogeneous mixture, the unburned overall enrichment was 2.54 wt.% (Ref. [3]). The TMI-2 fuel experienced the equivalent of approximately 94 effective full-power days of burnup at the time of the accident (Ref. [18]). The actual exposure history for each fuel batch, using existing plant data, was applied to calculate burnup effects. The exposures and core operating history were applied to the ORIGEN-S model to calculate isotopic inventory at the time of the accident. The incorporation of the burnup effects for each fuel batch was used to produce a net ^{235}U enrichment of 2.24% for a homogeneous mixture of the three batches (Ref. [19]). This is in good agreement with samples retrieved from the bottom head with an average enrichment of 2.23 wt.% $^{235}U/U$ (Ref. [20]).

The starting fuel composition is decayed using ORIGEN to the year 2022. Those nuclides that do not have available nuclear data in the ENDF-B/VIII library are not included. Almost all of the neglected nuclides have decayed weight fractions less than 10^{-15}.

1. The burnup and decay of UO_2 includes various isotopes other than uranium and oxygen. The table of impurities considers this component as 'fuel composition'.

Appendix A – Fuel Debris Composition lists the starting fuel composition (Table 9-1) and the decayed composition (Table 9-2) used in the simulations. The neglected components are highlighted.

Nuclides that decreased in the decayed composition are ^{151}Sm, ^{241}Pu, ^{151}Eu, ^{154}Eu, and ^{155}Eu. The largest decrease is in ^{154}Eu and ^{155}Eu. An energy dependent cross section plot for these nuclides can be found in Figure 9-1 in

Appendix A – Fuel Debris Composition. The decrease (decay) in these two europium isotopes has resulted in an increased reactivity. Nuclides that increased in the decayed composition, originally from zero, to be above 1×10^{-7} are ^{241}Am, ^{234}U, and ^{155}Gd; however, they are still pretty low in abundance ($\sim1\times10^{-6}$). A cross section comparison for these nuclides can be found in Figure 9-2 in

Appendix A – Fuel Debris Composition. Based on the abundance of these nuclides and their cross section data, it is expected and confirmed through scoping that the decayed fuel composition is slightly more reactive than the original burn-up composition. This would present a more conservative fuel composition for the SFML calculation.

Full theoretical density (10.97 g/cm^3), as well as a reduced density (10.55 g/cm^3) based on burn-up history (Ref. [21]), and an as-built density of 92.5% of the theoretical density (10.14 g/cm^3) (Ref. [14]) are all used in the scoping calculations; however, the effect on reactivity is minimal. The relative density as a function of burn-up is expressed as:

$$\frac{\rho}{\rho_{th}} = 0.963 - 1 \cdot 10^{-4} \cdot (burnup)^{3/2}$$

5.3.2. Impurities

All samples of TMI-2 debris accumulations collected have shown that debris contains impurities, whether those be from structural material, control rods, burnable poison rods, coolant poison, or cladding. In many cases, impurities from each category were present in the sample. These are considered long-term impurities of the debris, not surface contaminants. A summary of previous analyses is in Section 4 with additional details in Reference [1]. Substantial fuel, control rod, and structural material mixing to create some degree of homogeneity was shown to have occurred during the TMI-2 accident. Additional justification of this from supporting documentation is also provided in Reference [1].

Core debris in the lower head region of the RV is most representative of what remains in the RV at the present time. For this reason, the impurity concentration is derived from the sampling results for the lower head of the RV. A composition representing the RV lower head was initially derived as 'Mix 3' in the *Defueling Completion Report* (Ref. [3], Table 5-11). In this mix, the fuel composition (UO_2+fission products) makes up 83.79 wt.% of the core debris while the remainder (16.21 wt.%) is impurities. The debris composition with impurities is listed in Table 5-2. Homogenization of the impurity content of the RV lower head in the modeled fuel mixture represents a significant conservatism over what would be derived assuming a homogeneous mixture of the initial core composition, where the UO_2 component is 65.8 wt.% of the TMI-2 core mass (Ref. [22]).

Table 5-2. Impurity Content of Core Debris ('Mix 3')

Component	Weight Percent (%)
Fuel Composition	83.79
Zr	12.70
Fe	2.44
B	0.11
Cd	0.00
Cr	0.75

Mo	0.15
Mn	0.06

The impurity composition within the core debris is varied in the analysis from 0% to 16.21 wt.%. In addition, iron content is fixed at 90% of the relative impurity mixture and boron content is varied independently since the greatest reactivity worth comes from these constituents. This allows the SFML result to not rely on full credit from boron or iron impurities. Calculation of the modeled weight fraction of boron is performed using the following relationship, where B_{mult} is the element's (e.g., boron's) multiplier. The same is done for iron where B_{mult} is replaced with 0.9.

$$B_{modeled} = \frac{Imp\ wf}{core\ debris} \cdot \frac{B_{Mix3}}{Imp\ wf} \cdot B_{mult}$$

The overall fuel debris boron concentration for each multiplier is shown in Table 5-3 for all impurity fractions used. The values shown are weight percent of boron in total fuel debris.

Table 5-3. Overall Boron Concentration in Fuel Debris

B_{mult}	Impurity Fraction (wt.%)			
	5	10	15	16.21
0	0	0	0	0
0.2	0.0068	0.014	0.020	0.022
0.3	0.010	0.020	0.031	0.033
0.5	0.017	0.034	0.051	0.055
0.8	0.027	0.054	0.082	0.088
1	0.034	0.068	0.10	0.11

5.4. Results

Note that calculation results in this section are generally in the form of total uranium, not total UO_2.

5.4.1. Optimum Conditions

An optimum moderation search is performed by adjusting the fuel pellet diameter and lattice pitch (i.e., H/U ratio). Once the most reactive arrangement is identified, that pellet size, pitch and fuel density can be used to examine variations on the total fuel mass, total impurity content, boron concentration, and reflector material.

The fuel pellet radius is varied from 0.2 cm to 0.6 cm, and the pellet separation from 0.1 cm to 0.4 cm in an effort to identify the optimum conditions for maximum reactivity. The fuel volume fraction for randomly packed whole fuel pellets is around 0.63, and a volume fraction of 0.74 corresponds to the maximum that can be achieved for spheres in contact in a hexagonal lattice. A pellet radius of 0.6 cm with a separation of 0.1 cm results in a fuel volume fraction of approximately 0.634, slightly higher than that for randomly packed spherical pellets. A pellet radius of 0.6 cm with a separation of 0.4 cm results in a fuel volume fraction of 0.34. As the pellet size and separation distance (i.e., unit cell pitch) are varied, the optimum moderation can be found. Since the fuel is low enriched, moderation is necessary to achieve criticality. A higher fuel volume fraction (i.e., less moderator present) in each modeled unit cell results in a reduced reactivity. For this reason, the pellet radius and pitch are not varied beyond these specified values. It is recognized that fuel pellet sizes larger than 1.2 cm may exist due to fuel melting. However, sample data have shown, and temperature-dependent phenomena indicate that particles of pure UO_2 are highly unlikely.

The optimum UO_2 density for all cases is 10.97 g/cm^3.

A graphic depiction of the change in k_{eff} for varying fuel/moderator ratios at 1200 kg U is provided in Figure 5-3. The maximum k_{eff} for the system with minimal impurities occurs around ~1.5. There are multiple fuel radius and pitch values that can produce the same ratio (e.g., 0.4 cm radius; 0.2 cm pitch and 0.6 cm radius; 0.3 cm pitch both have a ratio of 2) with slightly different k_{eff}.

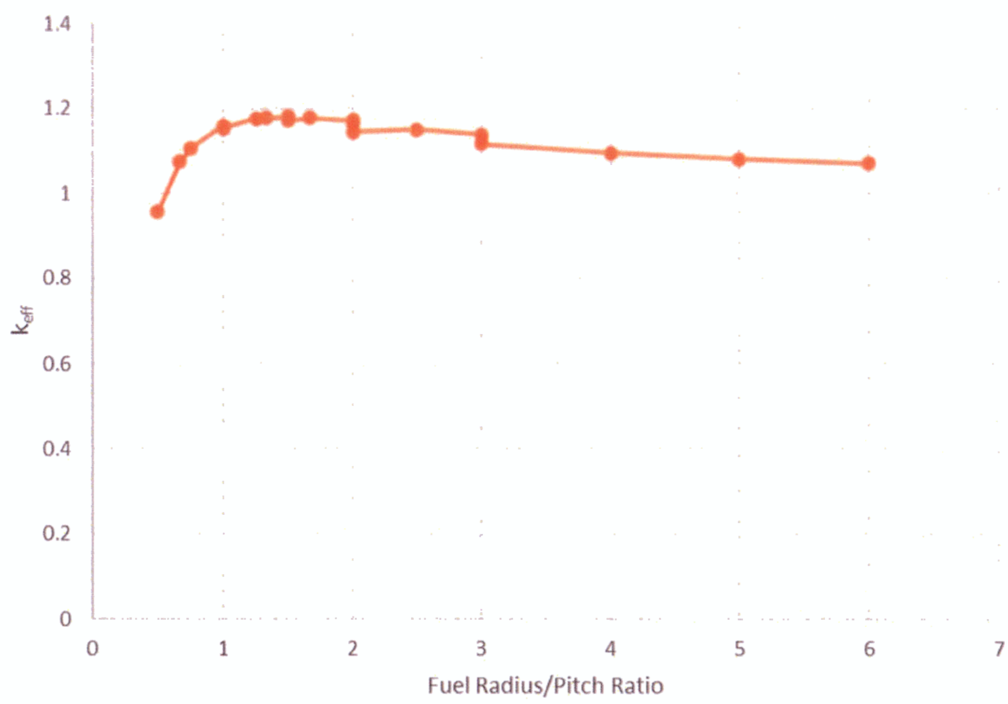

Figure 5-3. Variation in Reproduction Factor as a Function of Fuel-to-Water Volume Ratio and Boron Content

5.4.2. Impurity Content

The weight fraction of the 'Mix 3' impurity applied to the fuel composition has a significant effect on the neutron multiplication factor. Although the impurity mix has multiple constituents, in reality made up from the melting and mixing of structural components and control rods, the boron has the highest neutron absorption cross section for the energy region of interest and therefore the greatest reactivity worth.

To show the effect of overall impurity concentration in the fuel debris on k_{eff}, the uranium mass is fixed at 1200 kg. The boron concentration is adjusted by a multipler on the value provided in 'Mix 3' (i.e., 30% is a 70% reduction). Figure 5-4 displays the negative reactivity worth with each small addition of boron. For 15 and 16.21 wt.% impurity content, 20% of the boron impurity is worth approximately -15.07% Δk/k. In other words, -0.75% Δk/k on average for each 1% addition of boron in the fuel mix. The positive and negative reactivity worth is reported in comparison to the k_{eff} with no boron impurity rather than from unity since deviation from a purely critical state is not part of this study. As the boron impurity increases, it's negative reactivity worth decreases with each addition. This is apparent by looking at the slope of the curve near the 100% multiplier. Over the entire range of boron multipliers, the average worth is -0.48% Δk/k for each 1% addition. For 5 wt.% impurity content, 20% of the boron impurity is worth approximately -5.52% Δk/k. In this case, there is an added 0.27% Δk/k of negative reactivity on average for each 1% addition of boron in the fuel mix. For 10 wt.% impurity content, 20% of the boron impurity is worth -11.4% Δk/k, or -0.57% Δk/k for each 1% addition. As expected, as the impurity weight percent increases, boron has a more significant impact on k_{eff}.

The reactivity worth of boron in the impurities is similar for the range of uranium loadings examined (925 kg – 1750 kg U) but has a slightly higher worth at lower fissile loadings. Note that in all these results, only 90% of the iron is credited.

For a 1200 kg U fuel loading, if 15 wt.% or more of the total impurity content is credited, at least 28% of the boron also has to be credited in order to stay below the USL. If 10 wt.% of the impurities is credited, at least 47% of the boron content must be credited to stay below the USL. With a boron multiplier of 1 (100%), the boron is 0.11 wt.% of the fuel debris (see Table 5-2 and Table 5-3). With a boron multiplier of 0.47, the boron concentration is 0.0517 wt.% of the fuel debris. Using an impurity content of 10 wt.% and boron multiplier of 0.47, the overall boron impurity in the fuel debris required to stay below the USL is a minimum of 0.0319 wt.%.

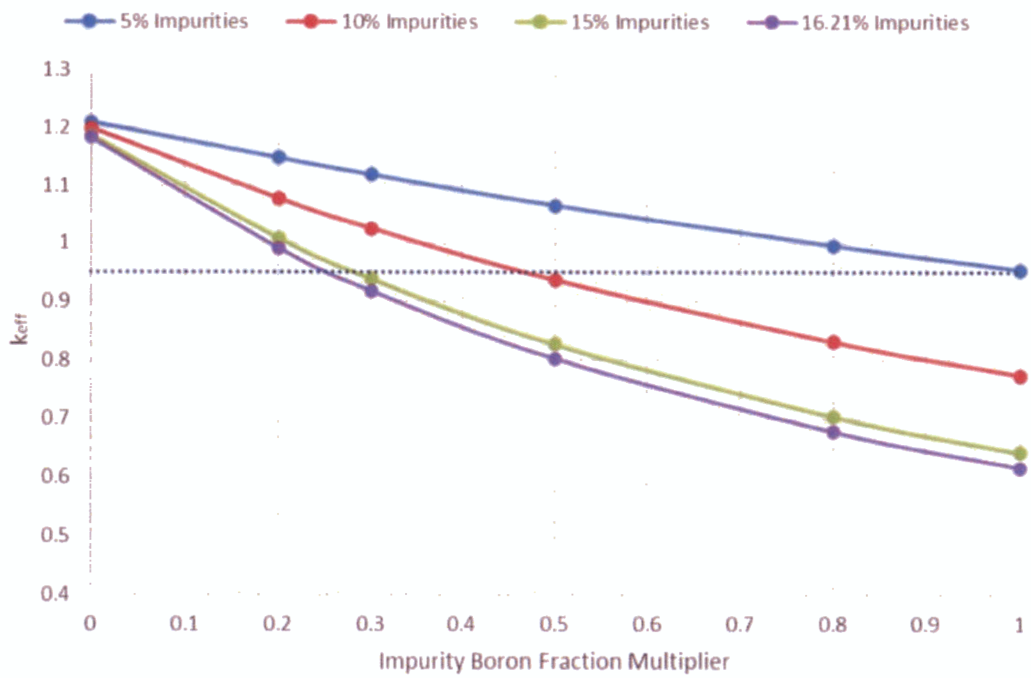

Figure 5-4. Variation in Reproduction Factor for Each Impurity Concentration as a Function of Impurity Boron Content

5.4.3. Reflector Material Sensitivity

The tight fitting (i.e., effectively infinite) water reflector is used in the reported results in this section. The water is replaced with concrete to test the sensitivity of this parameter since concrete is present in the TMI-2 facility and it is possible that decommissioning operations will expose components to it. It is not considered credible that a tight fitting concrete reflector could be realized during decommissioning operations.

Comparison of the neutron multiplication factor for a uranium loading ranging from 925 kg to 1500 kg for 10 wt.% impurities and 50% boron impurity multiplier at optimum moderation for both a water and concrete reflector is provided in Table 5-4. The tight fitting concrete reflector provides approximately +0.0065 Δk/k at 1200 kg uranium loading.

Table 5-4. Sensitivity of Reproduction Factor to Concrete Reflector

Reflector	U mass (kg)	$k_{eff} + 2\sigma$
Water	925	0.9235
	1125	0.9334
	1200	0.9365
	1500	0.9465
Concrete	925	0.9313
	1125	0.9401
	1200	0.9427
	1500	0.9519

5.4.4. Summary of Results

These results indicate that the entire remaining amount of uranium in the TMI-2 facility with some margin can be safely handled for decommissioning operations by taking credit for some impurity content. This analysis optimized moderation, fuel density, pellet size, and fuel configuration while taking partial credit, yet still applying conservative assumptions for fuel burn-up, fission products and decay, enrichment, impurity weight fraction and boron and iron content in the fuel debris. It is feasible to apply a SFML of 1200 kg U (1361 kg UO_2) with a $k_{eff} + 2\sigma < 0.95$ through taking credit for 10 wt.% of the impurities, 50% of the sampled boron content of those impurities, and 90% of the iron content of 'Mix 3' ($k_{eff} + 2\sigma = 0.9365$). This equates to 0.034 wt.% of boron in the fuel debris and 1.51 wt.% of iron. Only 31% of the reported boron content and 62% of the reported iron content of the fuel debris (for the lower head RV sample results) is credited in a 1200 kg U SFML. With an estimated remaining core debris inventory of 1097 kg UO_2, of which 90+% is in the RV, this SFML bounds all operations and credible upsets, including concrete reflection, and allows some margin for inventory and impurity uncertainty.

6. UPSET CONDITIONS

There are upset conditions associated with both the expected inventory of total uranium and its associated characteristics, and the decommissioning operations. Some upsets on the input parameters would require gross errors in historical information in addition to the absence of understood phenomena (i.e., nuclear fuel burn-up). Supporting information is provided both in this document and in reference documents on the assertion that anticipated phenomena has occurred and lead to the current conditions. One example of this is evidence of vast mixing of core components during the accident, which leads to impurity content in the fuel debris.

Upset conditions associated with decommissioning operations may include mishandling of components with fissile material to increase moderation, reflection conditions, or interaction conditions. This could potentially occur through removal and accumulation of fissile-bearing components from multiple areas into a single location. Given the size and complexity of the reactor components, and the effort required to remove and move each component, it is at least unlikely that a "pile" of reactor components can develop. Even if such a pile were to develop, the fissile material is at least partially adhered to structural members such that it's accumulation into a favorable geometry, either under water or not under water is not credible. Water (or gravity) serves to disperse and move any loose uranium thereby aiding in prevention of an ideal formation.

As components are removed from their in-situ location and moved to the reactor cavity for segmentation, they are cut and placed into a TSC. It is possible that pieces that do not fit may be placed aside. It is not credible that the segments placed aside could assemble into an ideal configuration with no structural components present. However, even if this were to occur, it would require gross errors in impurity content to erode the safety margin provided by these inherent characteristics of the fuel debris.

Development of the SFML includes optimization of parameters for maximum moderation, reflection and interaction conditions in a bounding geometry. Although the RV is flooded with water and a water reflector is considered as the material for all reported calculations, a tight fitting concrete reflector is also examined (see Section 5.4.3) and shown to only slightly increase the reactivity. The slight increase in reactivity offered by a tight fitting concrete reflector bounds any added reactivity from concrete walls or slab during decommissioning operations. There is sufficient margin between the base case reproduction factor and the USL to allow tight-fitting, effectively infinite concrete reflection, which is not considered a credible condition.

The derived SFML bounds the entire expected fissile mass inventory throughout all physically separated areas within the reactor building. The largest uncertainty is associated with the RV at ± 370 kg UO_2. The uncertainties on the fuel debris total mass associated with other areas are considered small, as these areas are better characterized (Ref. [4]). Including the maximum uncertainty, the total fuel debris for the RV could be ~1468 kg UO_2. It is not logistically possible for the entire mass of the RV, which is deposited in a large area, to be removed at one time. Nor is it possible for the entire mass associated with the RV to be placed into a single TSC. The nature of segmentation operations separate and reduce the amount of fissile material in a single area and subsequently any TSC. There is estimated to be approximately 170 kg UO_2 outside of the RV. It would require an unreasonable uncertainty associated with the other remaining areas to approach the estimated mass for the RV, and this is not considered credible. It is estimated that approximately 14 TSCs are necessary to pack the reactor components and internals when they are packed efficiently. There is no credible upset that could lead to a fuel debris mass of greater than 1468 kg UO_2 in a single location, nevermind an idealized configuration.

There are uncertainties associated with the impurity content of 'Mix 3' as detailed in TMI2-EN-RPT-0003 (Ref. [1]) as they apply to the fuel debris for the entire facility. The impurities are reduced by approximately 38% from the specification in the Mix 3. The boron content is further reduced by 50% (~31% of the original B concentration remains) and the iron content by 10% (~56% of the original Fe concentration remains). These conservative reductions provide sufficient margin to encompass uncertainties and heterogeneous flucutuations in the remaining fuel debris material. In comparison to the other mixes, the boron concentration is approximately half that of Mix 4 (Ref. [3], Table 5-11) which is also derived from the sampling in the lower head of the RV. Additionally, the average boron concentration distribution for the OTSG samples was 0.109 wt.% (Ref. [1], Table 3-4), of which the value used in this calculation (0.034 wt.%) is approximately one third of that.

The above discussion demonstrates that it is not credible to expect all of the remaining fuel material to be collocated and for the resulting mass to exceed the determined 1200 kg U (1361 UO_2) SFML. It is further not considered credible that the segmentation operations would result in the fuel material being placed in an optimal physical arrangement that maximizes reactivity. A conservative approach to adequately represent the inherent characteristics of the remaining fuel debris is taken with respect to the development of an SFML for the remaining decommissioning activities. This, coupled with conservatively estimated masses and planned decommissioning operations provides significant and adequate margin of safety to ensure that a criticality is not credible.

7. CONCLUSIONS

The identified SFML to bound all planned TMI-2 decommissioning operations (i.e., normal conditions) and credible operational upsets is 1200 kg uranium or 1361 kg UO_2. This limit credits several key factors:

- 10 wt.% of the impurities identified in 'Mix 3' from the Defueling Completion Report, which is considered representative of the debris that remains in the RV;
- Boron and iron are further reduced by 50% and 10%, respectively, in the 10 wt.% impurity fraction identified in 'Mix 3'; and
- Actual exposure histories applied to the average enrichment for all three batches of original TMI-2 fuel (burn-up credit).

And applies multiple conservatisms:

- A decayed fuel composition to the year 2022 which reduces key fission product poisons beyond the value used in the existing SFML calculation;
- Neglecting the removal of ~65% of the highest enrichment fuel assembly;
- Optimum moderation (fuel pellet to pitch ratio);
- Effectively infinite reflection;
- Optimum spherical core geometry; and
- Theoretical fuel density above the as-built specification for TMI-2.

The derived SFML bounds the entire expected fissile mass inventory throughout all physically separated areas within the reactor building. The bounding fissile mass used to produce the SFML is assembled in idealized conditions that cannot credibly exist during decommissioning operations. Even if the expected remaining fissile mass throughout the building (1097 kg UO_2), including hold up in all piping and cubicles were to be brought together, a criticality is not feasible. There are no credible operational upsets to realize the ideal configuration but even in the event that the upset occurs, it would require fissile mass in excess of that analyzed, which is greater than what is anticipated, in addition to a greatly reduced impurity concentration to present a criticality hazard.

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9. APPENDIX A – FUEL DEBRIS COMPOSITION

Table 9-1 – Fuel Composition as Calculated in 1988 (Ref. [3])

Nuclide	ZAID	Number Density (atoms/barn-cm)
^{235}U	92235	5.21E-4
^{238}U	92238	2.25E-2
^{16}O	8016	4.60E-2
^{239}Pu	94239	4.01E-5
^{240}Pu	94240	2.00E-6
^{241}Pu	94241	2.49E-7
^{149}Sm	62149	1.01E-7
^{151}Sm	62151	1.79E-7
^{151}Eu	63151	8.20E-9
^{153}Eu	63153	1.32E-7
^{154}Eu	63154	4.51E-9
^{155}Eu	63155	6.12E-9

Table 9-2 – Fuel Composition as Calculated for 2022

Nuclide	ZAID	Number Density (atoms/barn-cm)
^{4}He	2004	5.160E-08
^{207}Tl	81207	1.785E-21
^{209}Tl	81209	1.251E-29
^{206}Pb	82206	3.238E-22
^{207}Pb	82207	1.618E-15
^{208}Pb	82208	7.470E-25
^{209}Pb	82209	5.044E-26
^{210}Pb	82210	1.586E-21
^{211}Pb	82211	1.355E-20
^{212}Pb	82212	1.501E-28
^{214}Pb	82214	1.715E-26
^{209}Bi	83209	6.484E-22
^{210}Bi	83210	9.806E-25
^{211}Bi	83211	8.030E-22
^{212}Bi	83212	1.424E-29
^{213}Bi	83213	1.178E-26
^{214}Bi	83214	1.274E-26
^{210}Po	84210	2.512E-23
^{211}Po	84211	8.906E-27
^{215}Po	84215	1.114E-26
^{218}Po	84218	1.983E-27
^{219}Rn	86219	2.476E-23
^{222}Rn	86222	3.524E-24

^{221}Fr	87221	1.266E-27
^{223}Fr	87223	1.137E-22
^{223}Ra	88223	6.176E-18
^{224}Ra	88224	1.239E-27
^{225}Ra	88225	5.545E-24
^{226}Ra	88226	5.386E-19
^{228}Ra	88228	8.651E-25
^{225}Ac	89225	3.721E-24
^{227}Ac	89227	4.287E-15
^{228}Ac	89228	1.056E-28
^{227}Th	90227	9.954E-18
^{228}Th	90228	2.356E-25
^{229}Th	90229	9.976E-19
^{230}Th	90230	5.350E-15
^{231}Th	90231	2.155E-15
^{232}Th	90232	3.402E-15
^{234}Th	90234	3.323E-13
^{231}Pa	91231	1.693E-11
^{233}Pa	91233	2.232E-16
^{234}Pa	91234	6.159E-18
^{233}U	92233	2.580E-14
^{234}U	92234	1.149E-10
^{235}U	92235	5.210E-04
^{236}U	92236	6.961E-09
^{237}U	92237	1.594E-15
^{238}U	92238	2.250E-02
^{237}Np	93237	6.478E-09
^{239}Pu	94239	4.006E-05
^{240}Pu	94240	1.993E-06
^{241}Pu	94241	5.023E-08
^{241}Am	95241	1.923E-07
^{149}Sm	62149	1.010E-07
^{151}Sm	62151	1.388E-07
^{151}Eu	63151	4.838E-08
^{153}Eu	63153	1.320E-07
^{154}Sm	62154	7.550E-13
^{154}Eu	63154	3.156E-10
^{154}Gd	64154	4.194E-09
^{155}Eu	63155	4.972E-11
^{155}Gd	64155	6.070E-09
^{16}O	8016	4.600E-02

*Highlighted rows are nuclides excluded from the simulations.

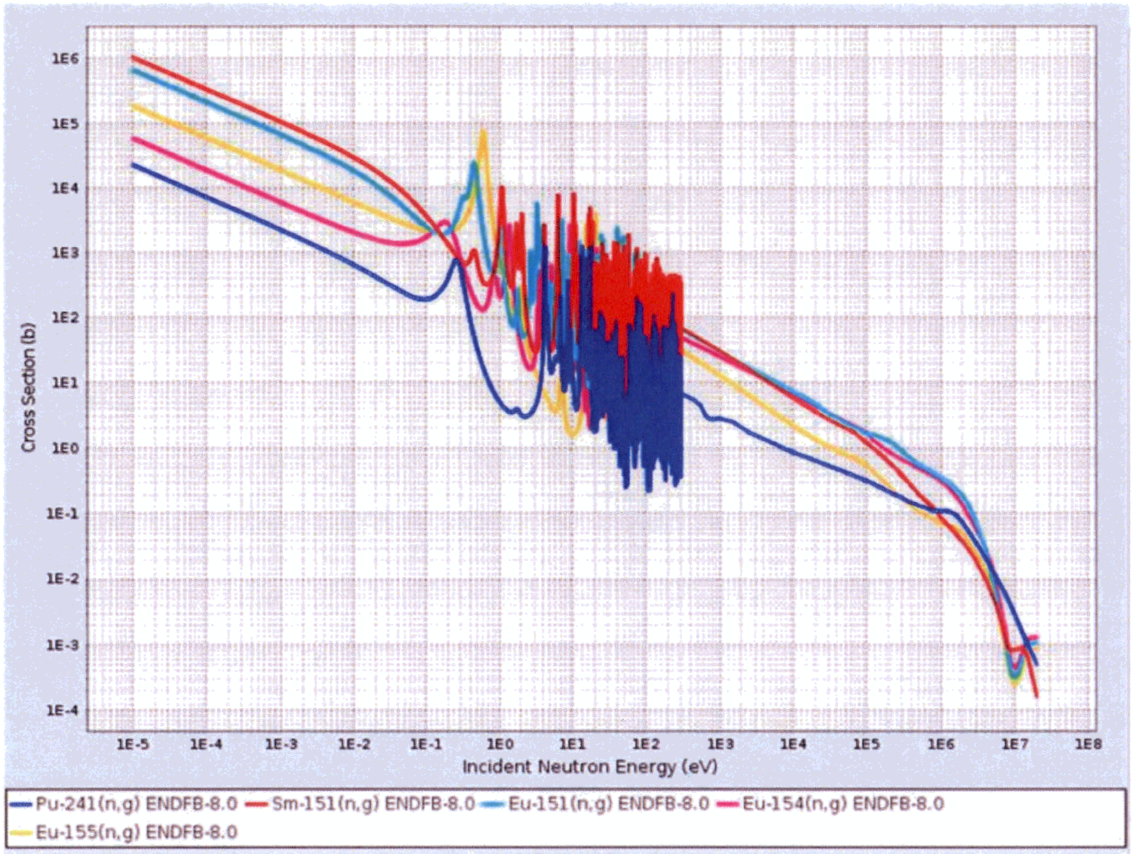

Figure 9-1. Energy Dependent Cross Section for Nuclides that Increased in the Decayed Composition

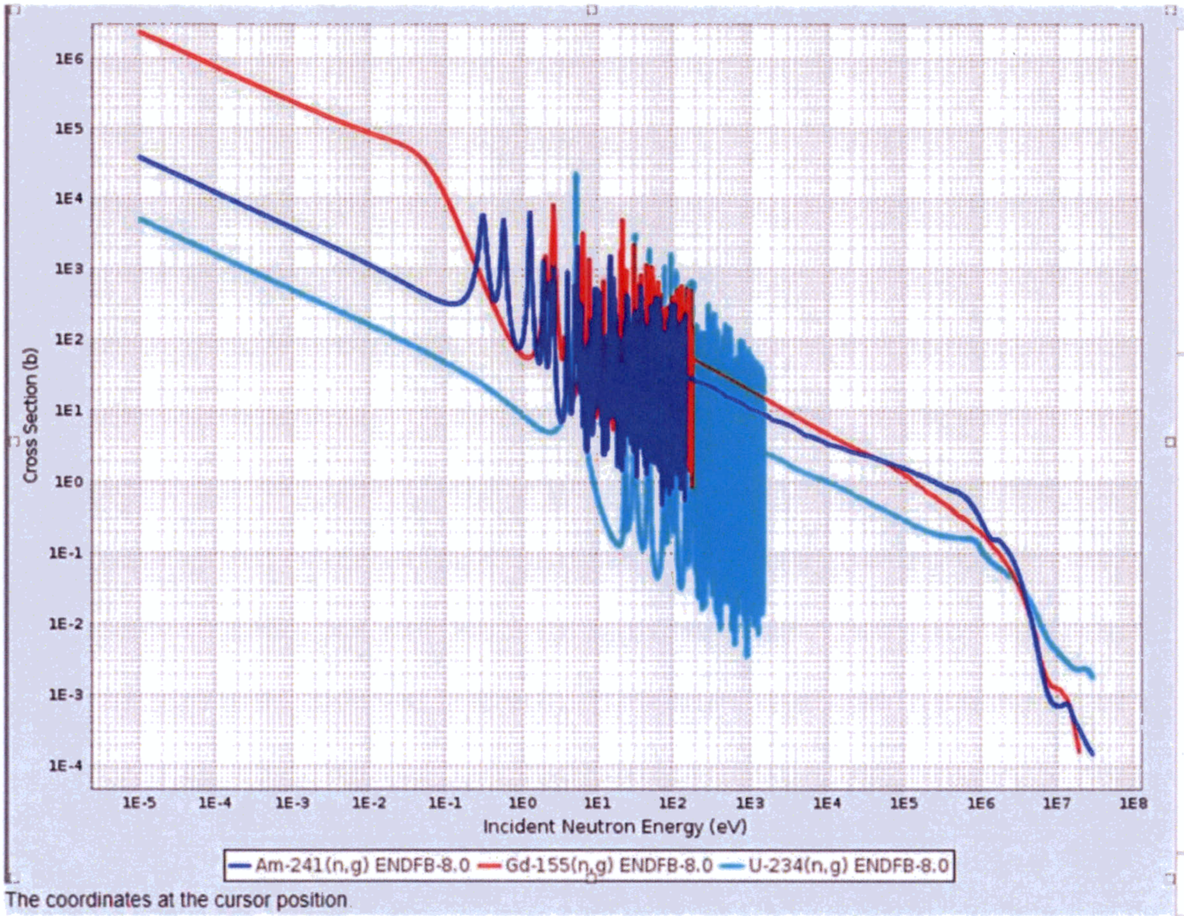

Figure 9-2. Energy Dependent Cross Section for Nuclides that Increased in the Decayed Composition

10. APPENDIX B – SAMPLE MCNP6 COMPUTER INPUT

TMI-sphereV8W_noBmod_0.4_1200_0.1_0.3.in

```
TMI-2 - sphere model water reflector with all impurities, no poison water
c Separation 0.4 cm
c No Soluble poison is in moderating water
c Refined fuel composition from V5 - from 'origen decay comp' file
c Simple sphere model with fuel plus impurities
c Iron content fixed at 10% reduced from reference
c  Parameters
c U mass (kg) = 1200
c Impurities wt frac: 0.1
c Fuel wt frac:0.9
c Impurities Boron multiplier = 0.3
c Iron multiplier = 0.9
c Fuel Density = 10.97
c Borated moderating water, no boron in reflector water
c Boron in water by weight = 0
c Water Boron multiplier = 0
c pitch = 1.6
c HexVolume = 3.5472
c Fuel Vol= 0.90478
c U Concentration = 2.2161
c  Hexagonal prism unit cell
c  UO2 fuel, enrichment=2.24%
c
c
c  -------------------CELL CARDS-----------------------------------------
c      FUEL UNIT CELL
10 100 -10.97        -4             u=2              imp:n=1     $ fuel inside pellet
20 400 -0.998207  4            u=2             imp:n=1     $ water around fuel pellet
c      LATTICE as UNIVERSE 1 FILLED WITH UNIVERSE 2
50 0             -3 lat=2 fill=2 u=1             imp:n=1     $ hexagonal lattice
c      SQUARE LATTICE AS UNIVERSE 3 FILLED WITH UNIVERSE 1
60 0             -5            u=3 lat=1 fill=1 imp:n=1
70 0             -1                   fill=3 imp:n=1   $ space filled by Universe 3
(lattice)
c      WATER REFLECTOR
80 400 -0.998207 -2 1                           imp:n=1    $ water outside core
c      NEVERLAND
500 0   2                                      imp:n=0

c  -------------------SURFACE CARDS---------------------------------------
c    rph    xyz of bottom of prism, height, 0 p 0, vector to 2nd facet, vector to 3rd facet
c
c      CORE AND REFLECTOR
1    sph    0 0 0   50.563                   $ whole core sphere for lattice
2    sph    0 0 0   80.563              $ water reflector sphere
c      FUEL PELLET
3    rhp    0 0 -10  0 0 20  0 0.8          0       $ hexagonal prism cell, p=2
4    sph    0 0 0  0.60                        $ fuel sphere, r=0.50
5    rpp    -500 500 -500 500 -0.80 0.80   $ divider for unit cells

c --------------------DATA CARDS------------------------------------------
c -------------------KCODE SOURCE-----------------------------------------
kcode 10000 1.0 50 1050                        $ 10000 particles per cycle, 1050 cycles, skip
50 cycles
sdef pos= 0 0 0
c
c ------------------MATERIALS---------------------------------------------
c
c ------------UO2 fuel; Density=10.97 g/cc 2.24% enr; ORNL Report------------
m100    2004.00c -2.986e-08                                          $ He-4
c        81207.00c -5.342e-20                                         $ Tl-207
c        81209.00c -3.779e-28                                         $ Tl-209
       82206.00c -9.643e-21                                          $ Pb-206
       82207.00c -4.843e-14                                          $ Pb-207
       82208.00c -2.246e-23                                          $ Pb-208
```

```
c       82209.00c -1.524e-24                                                    $ Pb-209
c       82210.00c -4.814e-20                                                    $ Pb-210
c       82211.00c -4.132e-19                                                    $ Pb-211
c       82212.00c -4.601e-27                                                    $ Pb-212
c       82214.00c -5.307e-25                                                    $ Pb-214
       83209.00c -1.959e-20                                                    $ Bi-209
c       83210.00c -2.977e-23                                                    $ Bi-210
c       83211.00c -2.450e-20                                                    $ Bi-211
c       83212.00c -4.363e-28                                                    $ Bi-212
c       83213.00c -3.628e-25                                                    $ Bi-213
c       83214.00c -3.942e-25                                                    $ Bi-214
c       84210.00c -7.627e-22                                                    $ Po-210
c       84211.00c -2.716e-25                                                    $ Po-211
c       84215.00c -3.462e-25                                                    $ Po-215
c       84218.00c -6.251e-26                                                    $ Po-218
c       86219.00c -7.842e-22                                                    $ Rn-219
c       86222.00c -1.131e-22                                                    $ Rn-222
c       87221.00c -4.046e-26                                                    $ Fr-221
c       87223.00c -3.666e-21                                                    $ Fr-223
       88223.00c -1.991e-16                                                    $ Ra-223
       88224.00c -4.014e-26                                                    $ Ra-224
       88226.00c -1.760e-17                                                    $ Ra-226
       88225.00c -1.803e-22                                                    $ Ra-225
c       88228.00c -2.852e-23                                                    $ Ra-228
       89225.00c -1.211e-22                                                    $ Ac-225
       89227.00c -1.407e-13                                                    $ Ac-227
c       89228.00c -3.480e-27                                                    $ Ac-228
       90227.00c -3.267e-16                                                    $ Th-227
       90228.00c -7.769e-24                                                    $ Th-228
       90229.00c -3.304e-17                                                    $ Th-229
       90230.00c -1.780e-13                                                    $ Th-230
       90231.00c -7.200e-14                                                    $ Th-231
       90232.00c -1.142e-13                                                    $ Th-232
       90234.00c -1.125e-11                                                    $ Th-234
       91231.00c -5.654e-10                                                    $ Pa-231
       91233.00c -7.519e-15                                                    $ Pa-233
c       91234.00c -2.084e-16                                                    $ Pa-234
       92233.00c -8.695e-13                                                    $ U-233
       92234.00c -3.887e-09                                                    $ U-234
       92235.00c -1.771e-02                                                    $ U-235
       92236.00c -2.376e-07                                                    $ U-236
       92237.00c -5.462e-14                                                    $ U-237
        92238.00c  -7.744e-01                                                   $ U-238
        93237.00c -2.220e-07                                                     $ Np-237
        8016.00c  -1.064e-01                                                       $ O-16
        94239.00c  -1.385e-03                                                   $ Pu-239
        94240.00c  -6.917e-05                                                   $ Pu-240
        94241.00c  -1.751e-06                                                   $ Pu-241
        95241.00c  -6.702e-06                                                   $ Am-241
        62149.00c  -2.175e-06                                                   $ Sm-149
        62151.00c  -3.029e-06                                                   $ Sm-151
        62154.00c  -1.680e-11                                                   $ Sm-154
        63151.00c  -1.056e-06                                                   $ Eu-151
        63153.00c  -2.918e-06                                                   $ Eu-153
        64154.00c  -7.023e-09                                                   $ Eu-154
        63155.00c  -1.114e-09                                                   $ Eu-155
        64154.00c  -9.333e-08                                                  $ Gd-154
        64155.00c  -1.360e-07                                                  $ Gd-155
        40090.00c  -3.973e-02                                                   $ Zr-90
        40091.00c  -8.760e-03                                                   $ Zr-91
        40092.00c  -1.353e-02                                                   $ Zr-92
        40094.00c  -1.402e-02                                                   $ Zr-94
        40096.00c  -2.307e-03                                                   $ Zr-96
        26054.00c  -7.651e-04                                                   $ Fe-54
        26056.00c  -1.245e-02                                                   $ Fe-56
        26057.00c  -2.927e-04                                                   $ Fe-57
        26058.00c  -3.963e-05                                                   $ Fe-58
        5010.00c  -3.751e-05                                                   $ B-10
        5011.00c  -1.661e-04                                                   $ B-11
        24050.00c  -1.931e-04                                                   $ Cr-50
```

```
       24052.00c  -3.872e-03                                               $ Cr-52
       24053.00c  -4.476e-04                                               $ Cr-53
       24054.00c  -1.135e-04                                               $ Cr-54
       42092.00c  -1.309e-04                                               $ Mo-92
       42094.00c  -8.359e-05                                               $ Mo-94
       42095.00c  -1.455e-04                                               $ Mo-95
       42096.00c  -1.543e-04                                               $ Mo-96
       42097.00c  -8.933e-05                                               $ Mo-97
       42098.00c  -2.284e-04                                               $ Mo-98
       42100.00c  -9.321e-05                                               $ Mo-100
       25055.00c  -3.701e-04                                               $ Mn-55
c
c ------------MODERATING WATER; Density = 0.998207; PNNL-15870 --------------
m200   5010.00c   -0.000e+00                           $ B-10
       5011.00c   -0.000e+00                            $ B-11
       1001.00c   -1.119e-01                             $ H-1
       8016.00c   -8.881e-01                           $ O-16
MT200  h-h2o.40t                                          $ S(a,b) for light water
c
c ------------CONCRETE; Density = 2.3; PNNL-15870 ------------------------
m300  1001.00c 1.68018E-01
      1002.00c 1.93243E-05
      8016.00c 5.62969E-01
      8017.00c 2.14009E-04
      11023.00c 2.13651E-02
      13027.00c 2.13429E-02
      14028.00c 1.87425E-01
      14029.00c 9.52136E-03
      14030.00c 6.28389E-03
      20040.00c 1.80258E-02
      20042.00c 1.20307E-04
      20043.00c 2.51028E-05
      20044.00c 3.87884E-04
      20046.00c 7.43786E-07
      20048.00c 3.47720E-05
      26054.00c 2.48181E-04
      26056.00c 3.89591E-03
      26057.00c 8.99736E-05
      26058.00c 1.19738E-05
MT300 h-h2o.40t fe-56.40t                           $ S(a,b) for light water, iron
c
c --------------REFLECTOR WATER; Density =0.998207; PNNL-15870 ------------
m400  1001.00c  0.66733
      8016.00c  0.33267
MT400 h-h2o.40t                                     $ S(a,b) for light water
print
```

11. APPENDIX C – SAMPLE ORIGEN COMPUTER INPUT

TMIFuelDecay.inp

```
'TMI Decayed Source Input
=origen

case{
    title="TMI Decayed Source"
    lib{
        file="end7dec"  % ORIGEN Decay library
    }
    mat{
       units = moles
        iso=[
               U235 =8.6515E-04
               U238 =3.7363E-02
               O16  =7.6386E-02
               Pu239=6.6589E-05
               Pu240=3.3211E-06
          Pu241=4.1348E-07
          Sm149=1.6772E-07
          Sm151=2.9724E-07
          Eu151=1.3617E-08
          Eu153=2.1919E-07
               Eu154=7.4892E-09
          Eu155=1.0163E-08
        ]
    }
    time{
       units = YEARS
       start = 1989
        t = [1990 1991 1993 1997 2005 2013 2019 2021 2022]
    }
    print{
        nuc{ total=yes units=[MOLES] }
        cutoff_step = 5
        rel_cutoff = no
        cutoffs[ ALL=1.0E-30 ]
    }
    save=yes
}
end
```

12. APPENDIX D – ELECTRONIC FILES

12.1. Computer Runs

The files listed below do not include the files associated with the scoping calculation to determine optimum moderation. A list of those files is included with the electronic archive.

Filename	File Date	Computer Code	Version	Computer
TMI-sphereV8W_1200_onlyimp_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_1200_onlyimp_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_1200_onlyimp_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_1200_onlyimp_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_1200_onlyimp_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_1200_onlyimp_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_1200_onlyimp_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_1200_onlyimp_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBmod_0.4_1125_0.05_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.05_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.15_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1125_0.1621_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.05_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBmod_0.4_1200_0.15_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.15_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1200_0.1621_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.05_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.15_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_1500_0.1621_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.05_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBmod_0.4_925_0.1_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.15_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_0.2.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_0.2.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_0.3.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_0.3.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_0.5.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_0.5.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_0.8.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_0.8.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBmod_0.4_925_0.1621_1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1125_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1125_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1125_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1125_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1125_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1125_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1125_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1125_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1500_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1500_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1500_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1500_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1500_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1500_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1500_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1500_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1750_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1750_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1750_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1750_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1750_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1750_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1750_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_1750_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_925_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_925_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_925_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_925_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_925_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_925_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_925_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_onlyimp_925_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8C_noBmod_1125_0.05_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.05_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_1.inr	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1_1.ins	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.2.inr	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.2.ins	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.3.inr	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.3.ins	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.5.inr	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.5.ins	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.15_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1621_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1621_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1621_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1621_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1621_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1125_0.1621_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.05_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.05_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.05_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.05_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.15_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.15_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.15_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.15_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.15_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.15_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8C_noBmod_1200_0.1621_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1200_0.1621_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.05_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.8.inr	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_0.8.ins	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_1.inr	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1_1.ins	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.2.inr	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.2.ins	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.15_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_1500_0.1621_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.05_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8C_noBmod_925_0.1_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.15_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_0.2.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_0.2.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_0.3.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_0.3.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_0.5.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_0.5.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_0.8.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_0.8.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_1.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBmod_925_0.1621_1.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBimp_1200_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBimp_1500_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBimp_925_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBimp_1125_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1125_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1200_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBimp_1500_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1500_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_1750_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.05_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8W_noBimp_925_0.15_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.15_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_100.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_100.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_25.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_25.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_50.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_50.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1621_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_75.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBimp_925_0.1_75.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1125_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1200_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1500_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_1750_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.05.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.05.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.15.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.15.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.1621.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.1621.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.1.in	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8W_noBnoB_925_0.1.ino	12/8/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.05_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.05_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.05_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.05_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8C_noBimp_1125_0.05_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.05_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.05_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.05_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.15_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.15_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.15_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.15_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.15_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.15_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.15_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.15_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1621_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1621_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1621_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1621_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1621_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1621_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1621_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1621_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1125_0.1_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.05_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.05_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.05_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.05_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.05_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.05_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.05_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.05_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.15_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.15_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.15_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.15_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.15_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.15_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.15_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.15_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1621_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1621_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1621_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1621_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1621_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1621_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1621_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1621_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1200_0.1_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.05_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.05_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8C_noBimp_1500_0.05_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.05_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.05_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.05_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.05_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.05_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.15_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.15_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.15_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.15_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.15_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.15_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.15_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.15_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1621_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1621_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1621_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1621_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1621_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1621_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1621_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1621_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1500_0.1_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.05_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.05_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.05_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.05_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.05_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.05_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.05_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.05_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.15_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.15_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.15_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.15_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.15_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.15_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.15_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.15_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1621_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1621_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1621_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1621_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1621_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1621_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1621_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1621_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_1750_0.1_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01

TMI-sphereV8C_noBimp_925_0.05_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.05_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.05_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.05_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.05_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.05_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.05_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.05_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.15_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.15_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.15_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.15_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.15_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.15_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.15_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.15_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1621_100.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1621_100.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1621_25.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1621_25.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1621_50.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1621_50.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1621_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1621_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1_75.in	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMI-sphereV8C_noBimp_925_0.1_75.ino	12/10/2020	MCNP	6.2.0	NSTS-LS01
TMIFuelDecay.inp	12/10/2020	ORIGEN/SCALE	6.2.4	LAPTOP-MEGANP
TMIFuelDecay.out	12/10/2020	ORIGEN/SCALE	6.2.4	21888-L

12.2. Other Electronic Files

Filename	File Date	Description
Final SFML Results.xlsb	12/16/2020	Repository of all final MCNP k_{eff} results, tables, and plots.
Material comp and scoping.xls	12/16/2020	ORIGEN output for material composition; MCNP k_{eff} results for optimum moderation determination.